THE

JOURNAL OF GAS LIGHTING.

PUBLISHED QUARTERLY.

WITH AN INTERMEDIATE SUPPLEMENT ON THE 10TH OF EACH INTERVENING MONTH.

No. 12.] LONDON, JANUARY 10, 1850. [PRICE 1s.

CLEGG'S New Patent Gas Meter.—LONDON—24, REGENT-SQUARE.

In these Meters the varying height of the water makes no difference in the measure.

PRICE OF STATION METERS.

To measure	60,000	cubic feet	per 24 hours	£50
,,	120,000	,,	,,	75
,,	240,000	,,	,,	100
,,	500,000	,,	,,	150
,,	1,000,000	,,	,,	250
,,	2,000,000	,,	,,	400

CARTER'S Patent Safety Gas Valve or Main Cock.—Experience has demonstrated the superiority of this Invention as a substitute for the common Main Cock, which is so soon out of order, either becoming fixed or leaky, neither of which is likely to occur with these Valves. They have been several years in use in many of our largest establishments: in the Bank upwards of one thousand are fixed, where, as elsewhere, they are highly approved.

Many of the Gas Companies have adopted them for their Street Lamp Cocks, and thereby prevent the possibility of waste.

They are manufactured of all sizes, from 2-8 to 12 inches bore, and are cheaper than any other description of Cock now in use.

THOMAS LAMBERT and SON,

Patentees, corner of Short-street, New-cut, Lambeth; Manufacturers of Block Tin Tube, and every description of Gas, Steam, and Hydraulic Apparatus.

PATENT FLEXIBLE GAS TUBING.

JAMES LYNE HANCOCK'S Vulcanized Indiarubber Hose Pipes and Tubing. Manufactory (and Warehouse), Goswell-mews, Goswell-road, London.

Gas Companies, Engineers, Gas Fitters, and the Trade generally, are respectfully informed this Tubing is now manufactured to any size, from ¼ inch bore and upwards, in 100-feet lengths, and perfectly cylindrical, either with or without a spiral wire inside.

VULCANIZED GLAZED FLEXIBLE TUBING, from ¼ inch up to 1 inch diameter, made in 24-feet lengths; or, covered with silk or worsted, up to 100 feet.

VULCANIZED HOSE, for FIRE ENGINES, BREWERS' USE, and for standing great pressures (Rubber and Cloth combined), made to any length or size to fit the necessary screws, &c.

VULCANIZED INDIARUBBER AIR-TIGHT BAGS, made any size, for Gas Mains, with flexible tubes attached, and fitted with stopcocks complete.

JOHN BARLOW begs respectfully to acquaint Directors and Managers of Gas and Water Works, and his Friends in general, that his BUSINESS is TRANSFERRED from the Wenlock Iron Works to the larger and more commodious Premises of Messrs. H. and M. D. Grissell, REGENT'S CANAL IRON WORKS, EAGLE WHARF-ROAD, LONDON, by whom he has been appointed AGENT; and where he trusts he may be favoured with a continuance of the patronage with which, for more than a quarter of a century, himself and his predecessors have been honoured.

A large assortment of Retorts, Pipes and Connections, Lamp-posts, Tubing, Borings, and every other similar article required for the use of Gas and Water Works, will be kept in stock; and contracts for Tanks, Gasholders, Roofs, Purifiers, Valves, &c., and Gas Works complete, executed on as advantageous terms as by country manufacturers. Machinery of all sorts, Mill Work, and Town Castings, made on the shortest notice.

London, September, 1849.

IMPORTANT to Gas Works.—JAMES PHILLIPS and CO., 116, Bishopsgate-street Without, London, have made arrangements to supply Gas Companies and Contractors for Lamps with GLASS, at the following low net cash prices, cut to sizes and shapes, and delivered in any part of England or Scotland where there is railway communication:—

Crown glass,	1¼ oz.	to the foot, at	2½d.	per foot	super.
do.	18 oz.	,, ,,	4d.	,,	,,
Sheet glass,	13 oz.	,, ,,	2¾d.	,,	,,
do.	16 oz.	,, ,,	3d.	,,	,,
do.	21 oz.	,, ,,	4d.	,,	,,

All orders addressed as above will receive prompt attention.

GAS.—A pure and matchless light is obtained by using the PATENT CYLINDRICAL SUN GAS BURNERS at a saving of full 30 per cent. For economy, elegance, durability, and general purposes of lighting the Sun Gas Burner stands pre-eminent. To be seen burning and the above fully tested by an experimental meter, at the sole City of London Agents', DEANE, DRAY, and DEANE, Gas Engineers and Chandelier Manufacturers, London-bridge.

MESSRS. OAKES and CO., Alfreton Iron Works, Derbyshire, and Wenlock Iron Wharf, City-road, London, beg respectfully to inform Gas Companies and the Public, that the London Agency for the SALE of their CASTINGS is now transferred to Mr. ALFRED PENNY, who will always keep in stock at Wenlock Wharf a large supply of Retorts and Mouthpieces of different sizes, Socket and Flanch Pipes, Bends, Branches, Crosses, and Tees, Syphon Wells, Lamp-posts, &c. &c.; Fire Bricks, Tiles, and Clay, Iron Borings, and almost every article used in Gas and Water Works.

In calling attention to the above announcement, Mr. Penny begs to say that his best attention shall be given to any orders that may be entrusted to his care; and also to remind those interested in the matter, that Messrs. Oakes, from their long connection with Gas Companies, have, perhaps, the largest Stock of Patterns for Gas Apparatus of any house in the trade; and that their prices, taking into account the quality of their goods (being made of the best cold-blast iron), are unusually low.

METER INDICES.

J. CLUER, Gas Meter, Index Maker, and Model Machinist, No. 1, Bowling-green-lane, Clerkenwell, London.

INDICES and all other Apparatus for Gas Meters of every size and kind, made on the shortest notice, of the best metal, and of superior workmanship.

A. WRIGHT, Gas Engineer and Meter Manufacturer, 55, Millbank-street, near the Houses of Parliament, Westminster, respectfully calls the attention of Gas Companies and Engineers who are not yet provided with Station Meters to the fact that he has erected two of the largest machines of this kind in existence, the one for the Chartered Gas Company, London, the other for the Hibernia Gas Company, Dublin, for both of which he has obtained the highest testimonials.

To this branch of business A. W. devotes much attention, as well as to the Manufacture of all kinds of Experimental Machinery for Gas purposes.

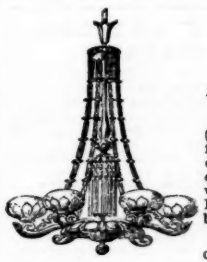
Consumers' Meters of all sizes at the usual prices, with a liberal discount to wholesale purchasers.

BRETTELL and WHITEHOUSE, late Brettell and Rufford, beg to inform Gas Companies and others requiring best STOURBRIDGE BRICKS and CLAY that they continue making all kinds of BRICKS, and warrant all their goods fully equal to any house in the trade.

Fire Brick Works, Stourbridge.

RUFFORD'S FIRE-BRICKS, RETORTS, CRUCIBLES, and CLAY. A large stock always on hand, and every description of Fire-proof goods carefully and promptly made to order.

FRANCIS TONGUE RUFFORD
(Sole Proprietor),
STOURBRIDGE.



F. & C. OSLER,

44, OXFORD-STREET, LONDON;

MANUFACTORY—BROAD-STREET, BIRMINGHAM,

Manufacturers of Glass Chandeliers, Glass Lustres, Table Glass, &c. &c.

ELEGANT CRYSTAL GLASS CHANDELIERS, FOR GAS

(Made from "REGISTERED" DESIGNS), with GLASS BRANCHES, &c.; suitable for DRAWING-ROOMS and BALL-ROOMS. From £4. 15s., upwards. The more extensive use of GAS in private dwellings has induced Messrs. OSLER to direct their particular attention to the manufacture of this class of articles—which, with a view to their general adoption, are offered at very moderate prices. Purchasers can select from a great variety of patterns, to which additions are being constantly made.

THEATRES, CONCERT, ASSEMBLY, AND BALL ROOMS LIGHTED BY ESTIMATE, ON THE LOWEST TERMS.

THOMAS EDGE, Patent Wet and Dry Gas Meter Works, Brass Foundry, Gas Fitting, and Chandelier Manufactory, WESTMINSTER. City Department, No. 6, POULTRY, CHEAPSIDE, LONDON.

Station Meters, Governors, Pressure Registers, Experimental Meters, and every description of Gas Apparatus, the accuracy of which may be fully relied upon.

Edge's Improved Portable Photometer—none like unto it. See JOURNAL OF GAS LIGHTING, June 11, 1849.

Edge's Triple Valve, both Hydraulic and slide, for Station Meters, Governors, and Purifiers, or, indeed, for any Apparatus requiring a by-pass, being "*three valves in one*," and at two-thirds the cost of the ordinary slide-valves.

THOMAS EDGE begs to call the attention of Gas Companies to the following Improvements possessed by his Patent Meter, contrasted with the defects of the common Meter as generally made at the present time:—

DEFECTS IN OLD METER.

OLD INDEX.

Difficulty in reading off the quantity consumed.

Frequent mistakes and misunderstandings in consequence.

OLD VALVE AND FLOAT.

This often becomes a fixture by the corrosion of the guide-wires, and fails to show a want of water in the Meter, whereby the Company is a loser.

OLD SYPHON AND SIDE-PLUG.

The Gas Company can at any time be defrauded at these points.

Liability to fire and explosion when the Syphon-plug is left out and gas on, or to explode the meter when the gas is off.

By unscrewing the side-plug, water can be abstracted, so as to make the Meter register considerably less than it ought.

IMPROVEMENTS IN PATENT METER.

PATENT INDEX.

No difficulty at all. The Index is read off as a common row of figures.

PATENT VALVE AND FLOAT.

The above cannot possibly become fixed, as the connecting wire never can touch any contiguous part; consequently the Float must fall when the water decreases.

PATENT SYPHON AND WATER-BOX.

No possibility of abstracting Gas, inasmuch as the Syphon-plug is sealed off by the dip-pipe below the water-box.

No side-plug is required, so that the water cannot possibly be drawn off below its proper level.

Again, the gas need not be turned off, should the Meter require water while the lights are in use, which is necessarily the case with other meters, and by which the consumer is subjected to serious inconvenience.

ANDREW McLAREN and CO., Steel-yard Wharf, 87, Upper Thames-street, London, have always in Stock a large Assortment of Cast-iron Socket and Hot-water Pipes, Wrought-iron Tubing with Connections, with a variety of goods adapted for every purpose, all of the best quality, and at the lowest price.—Contracts taken to any extent.

TO Gas Companies and others.—To be disposed of cheap, in good condition and well worth the attention of parties requiring such articles as the undermentioned, viz.:—

6 Spinney's Patent Valves.
10 D Mouthpieces, 12½ in. by 12½ in., and 20 Lids.
2 Circular ditto, 12 in. diameter, and 4 Lids.
A Washer of the tubular kind.

Application for particulars as to price, &c., to be made to the Manager of the Northampton Gas Light Company's Works, Augustine-street, Northampton.

January, 1850.

RAMSAY'S Garesfield Colliery, NEWCASTLE-UPON-TYNE.

COKING COAL and COKE of the best quality; superior CANNEL COAL, and FIRE GOODS of all descriptions.

Analysis of Garesfield Coke, by Dr. Richardson, of Newcastle:—

Carbon	97·60.
Ashes	1·55.
Sulphur	0·85.

Products of Ramsay's Newcastle Cannel Coal, as ascertained by Drs. Leeson and Miller, and G. H. Palmer, Esq.:—

Gas per Ton of Coal, cubic feet	9·667.
Specific Gravity	0·731.
Illuminating Power	1·85 to 2·03.

ordinary Newcastle Coal Gas being 1.

Coke per Ton of Coal .. .. .. 13¾ cwt.

Office, Broad Chare, Newcastle-upon-Tyne; and 46, Fenchurch-street, London.

PATENT GAS METER MANUFACTORY,
No. 66, Snow-hill, London.

WILLIAM SMITH, by the improvements he has made in the Wet Meter, and which he has secured by her Majesty's Royal Letters Patent, the accuracy of their registry is rendered certain by the introduction of the adjusting slide and hydraulic, whereby a Perfect Water Level is readily obtained, and the Hydraulic precludes the possibility of abstracting water from the meter by increased pressure or otherwise, thus surmounting the great desideratum of the Wet Meter. In his Patent Equitable Gas Meter neatness and strength are combined, the backs and fronts of the case being stamped by powerful machinery out of thick plate iron (tinned or galvanized); and the internal construction is of the best metal, which will resist the action of any impurity in the gas.

Old Meters may readily have the adjusting slide and hydraulic applied, thereby having accurate measurement assured.

Station Meters, Governors, &c., made on the shortest notice.

HARPERS and MOORE, of the Delph Fire-brick and Clay Works, Stourbridge, invite the attention of Gas Companies, Engineers, Oven Builders, and all consumers, to their Stock of FIRE-BRICKS, LUMPS, or BURRS, QUARRIES, CLAY, and other Goods, a large assortment of which is always kept at their London Depôt, No. 7, Wenlock-road, City-road; also Melting-pots for Brassfounders and Metal Refiners. These articles are made in a very superior manner from clay of the very best quality, and have been proved by metal-melters (who can be referred to) to have withstood the most severe tests, and for very long periods.

Shipping orders supplied, and every description of Fire-clay Goods made to pattern or drawings on the shortest notice.

H. and M. particularly invite the attention of Gas Companies to a trial of their Fire-clay Retorts, which they are now making in a very superior manner, and of a quality which, on trial, will be found to surpass anything of the kind hitherto produced. The superior quality and peculiar admixture of their clays enable them to manufacture an article which fully admits of the necessary expansion and contraction, to allow of their being let down at the end of a season, when the usual supply of gas is not required, and again put to work for successive seasons without fear of cracking or leakage from any other cause.

H. and M. further beg to direct attention to the evidence of Mr. Croll, given before a Committee of the House of Commons, relative to the use of Clay Retorts (see "Gas-lighting Journal" of April 10, 1849, pages 43 and 44). The Clay Retorts there referred to by Mr. Croll were made at, and supplied from, the works of Harpers and Moore, as above; they were put to work in August, 1846, and are now in full and constant operation.

Testimonials can be seen, and further information obtained, on application (if by letter, prepaid), addressed as above.

H. JONES, Gas Meter Manufacturer, No. 41, OLD-STREET, St. Luke's, London, begs respectfully to call the attention of Gas Companies to his latest improvements in the WET METER, by means of which water cannot be abstracted, neither can Gas by any possibility pass through the Meter without registering.

FIRE Clay Gas Retorts.—The subscribers have for many years been extensive manufacturers of FIRE CLAY RETORTS, and supply most of the works in the centre and east coast of Scotland. They will guarantee their Retorts to last from one to two years, and to give satisfaction. They are cheaper than iron, carbonize coal more quickly, and with less fuel. Their Retorts may be seen at work at Poplar Gas Works, London.

Price £2 to £3, according to size.

Fire Bricks and all other Fire Clay Articles furnished of best manufacture, and at moderate prices.

FRASER and SANDERSON.

Inverkeithing, March 6, 1849.

Annual Expense of Retorts at the Dunfermline Gas Work, showing the difference of Expense betwixt Iron and Inverkeithing Clay Retorts.

To May, 1835, Iron Retorts used	£161	1 10
1836, Do.	154	17 9
1837, Do.	167	17 0
1838, Iron, and Clay commenced	137	3 0
1839, Iron and Clay	81	18 0
1840, Clay Retorts	20	5 0
1841, Do.	29	5 0
1842, Do.	22	10 0
1843, Do.	24	0 0
1844, Do.	19	2 10
1845, Do.	14	14 0

PATENT FIRE-CLAY RETORTS.

ORLANDO BROTHERS and RAILTON, Manufacturers of O. Brothers's Patent, beg to state that these RETORTS being made in ONE ENTIRE OPERATION, and in ONE PIECE of any required shape, length, breadth, and height, are not liable to Cracks and Fissures, of which there is a just and general complaint; and they are consequently superior to and cheaper than any hitherto manufactured.

Prices per foot in length:—

	At Blackburn.	In London.
12 in. by 12	7s. 0d.	8s. 3d.
14 in. by 12	8s. 0d.	9s. 6d.
16 in. by 12	8s. 6d.	10s. 3d.
18 in. by 15	9s. 6d.	11s. 6d.
19 in. by 13	9s. 6d.	11s. 6d.
24 in. by 15	11s. 6d.	13s. 9d.

exclusive of the angle-iron flanges.

References and further particulars may be obtained on application to the Patentee, Gas Works, Blackburn; or to Messrs. George Barlow and Son, 9, Charterhouse-square, London.

WEST BROTHERS and CO.,
LATE
THOMAS WEST,
GAS METER MANUFACTURERS, BRASS FOUNDERS, &c., UNION-STREET, OLDHAM.

Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gas Holders, Governors, Slide Valves, &c. &c.

ESTABLISHED 1827.

JOHN BEVERLEY and SON, Manufacturers of the Improved METALLIC GAS METERS, 68, BRIGGATE, LEEDS,

In returning thanks to Gas Companies, and those who have been pleased to patronize the use of their Gas Meters, take leave to observe that they still continue to make the outer cases of Cast Iron, which are carefully fitted and put together with screws, and the interior wheel or drum of a composition that has stood the test of years.

Dealers in all kinds of Gas Fittings, Tubing, &c. &c.

WILLIAM SUGG, Gas Engineer and Manufacturer of Patent Wet and Dry Gas Meters, combining all the latest acknowledged improvements; Brass Founder, Gas Fitter, and Lamp Contractor; Manufacturer of all kinds of Plain and Ornamental Gas Apparatus, and Contractor for the Erection of Gas Works. Designs and Estimates submitted; Station Meters and Governors of any size.

Gas Meter and Apparatus Works, 19 and 20, Marsham-street, Westminster.

THE New Patent GAS LIGHT MONITOR, adapted to every description of Burner, and supplied at a cost placing it within the reach of every consumer of Gas, regulates the flame to any required height, economizing the consumption, and preventing the danger and inconvenience arising from the flaring and smoking of lights. It may be seen in daily use at the office of the Patentees, 20, King William-street, Charing-cross.

R. LAIDLAW AND SON, GAS ENGINEERS,

BRASS AND IRON FOUNDERS AND MANUFACTURERS OF GAS METERS, MALLEABLE IRON AND BLOCK-TIN TUBES, GAS LAMPS, PENDANTS, BRACKETS, AND FITTINGS, RETORTS, PIPES, and all APPARATUS required for GAS WORKS, of the best quality.

ORDERS promptly executed, and ESTIMATES given.

EDINBURGH AND GLASGOW.

THE Economic Gas-cooking Stove.— With this Registered Patent Apparatus, COOKING by GAS is performed with little trouble, cleanliness, and economy; and, if necessary, where there is no chimney. Those who have not seen how much heat can be obtained from a few jets of Gas, scientifically applied for Chemical, Manufacturing, or Culinary Purposes, are invited to inspect the different kinds of Apparatus at C. RICKET'S Manufactory, 5, Agar-street, Strand, opposite Charing-cross Hospital.

TO GAS COMPANIES.

JOHN EUNSON, Gas Engineer and Contractor for the Erection of Gas Works, continues to manufacture CLAY RETORTS upon the most approved principle, and of the best material.

Wolverhampton, May 5, 1849.

JOSEPH BOULTON, Gas Meter Manufacturer, No. 1, COPPICE-ROW, CLERKENWELL, LONDON, begs to call the attention of Gas Companies and the public in general to his improved GAS METER, containing all the latest improvements.

J. B. warrants all Meters to be manufactured of the best materials and workmanship, the wheels, &c., being of metal. Old Meters repaired on the lowest terms.

ESTABLISHED IN 1834.

S. KING, Gas Meter Manufacturer, 21, Cock-lane, West Smithfield, London.

Meters made of the best materials and workmanship, with all the recent improvements, and warranted correct in registration.

M. KELLY, Cast Iron Wharf, 31, Bankside, London.—Retorts of superior quality, Socket and Flange Pipes, Bends, Branches, Syphons, and every description of Castings for Gas and Water Works, Gasometers, Tanks, Purifiers, Condensers, &c., erected complete, or the materials supplied.

Gas Valves and Sluice Cocks on an improved principle. Patent Gas Tubing and Connections.

A stock of the above articles kept.

The Pipes and Retorts supplied by M. K. are cast vertically, which ensures soundness and equality of thickness throughout.

THOMAS ALLAN and CO., SPRING-BANK IRONWORKS, GLASGOW, have always on hand a large assortment of GAS PIPES and other Castings connected with Gas Works, which they beg to solicit orders for.

WM. PARKINSON
(Successor to the late Samuel Crosley),
COTTAGE-LANE, CITY-ROAD, LONDON,

Begs most respectfully to announce that he has, in addition to the continued manufacture of GAS METERS, commenced (under Patent) the manufacture of Meters for measuring Water, Spirits, &c.

N.B. These Meters are as simple and durable as the Gas Meter, and as correct as that instrument under the most careful manipulation.

BRYAN DONKIN and CO.'S Improved GAS VALVES (Registered). Messrs. Bryan Donkin and Co. solicit the attention of Directors and other Gentlemen connected with Gas Companies, to their improved GAS VALVES, which have been adopted and approved of by the principal Companies and Gas Engineers of London and elsewhere, on account of the advantages and greater security attained, and the more perfect adaptation to the purposes required.

As the Inventors consider the superiority of these Valves now fully proved, it remains simply to quote the prices:—

	Per in. diam.	Separate Spigot and Faucett Fittings. Per in. extra.
From 14 in. to 10 in., inclusive,	13s.	3s. 6d.
„ 9 in. to 4 in.,	„ 14s.	2s. 6d.
„ 3 in. to 2 in.,	„ 15s.	1s. 6d.

The above prices include an Indicator, for showing the extent to which the Valve is open.

Bryan Donkin and Co. also solicit the attention of the public to their newly-invented Registered SAFETY GAS VALVE, or SLIDE-COCK, for service mains. It is constructed with plane surfaces, presenting a straight and full-sized bore for the flow of gas, avoiding the cone and being as durable as the best slide-valves.

Engineers' Works, Grange-road, Bermondsey.

IRON Roofing Works, Southwark. Office—3 A, Mansion-house-place, London.
JOHN H. PORTER,
Patentee of the Corrugated Iron Beams, Girders, and Fireproof Floors;
Manufacturer of IRON ROOFS and BUILDINGS, Chiefly of
THE PATENT GALVANIZED IRON.

This material has been employed by J. H. Porter for several years past in the construction of Iron Roofing for Railway Stations and Dockyards, at home and abroad; Farm Buildings, Factories, Gasworks, Warehouses, &c.; Sugar-houses, Megass and Coffee Sheds, Stores, Dwellings, and Market-places, in the East and West Indies, China, at the Cape of Good Hope, and in other parts of the world; Iron-bar and Strained-wire Fences, Sheep and Cattle Hurdles.

CAST Iron Retorts, Socket Pipes, and Connections of every size suitable for Gas and Water Works, Lamp Columns, Wrought Iron Tubing, Hot Water Pipes, Rain Water Pipes, and Eaves Gutters, in stock, and sold on the lowest terms, at LYNCH WHITE'S Iron Wharf, 66, Bankside, London.

M. SHEEN, Gas and Railway Lantern Maker, 90½, Holborn-hill, begs to inform Managers of Gas Works, &c., that she continues to contract and supply Lanterns on reasonable terms, and keep them in repair by the year.

CLARK'S Gas Burners. — Gas Fittings.—The Star, the Glass, and the Reflecting Gas burners are the best in existence.—Every Burner bears a label, "CLARK'S PATENT."—The price is from 3s. 6d. complete.—A most brilliant Light. They are shadowless, and all smoke is consumed. They effect a great saving in Gas. Every one should use these Burners. The Gas Fittings are cheap and well made. The Gas Chandeliers are magnificent in design and very low in price, beginning at 42s. No one should buy without first calling to see the immense Stock of Gas Fittings constantly on show. The Metropolitan Light Company also Contract and Fix Gas Work.—RICHARD CLARK, Resident Manager, 447, West Strand.—Please write down the address.

GUTTA PERCHA TUBING.

GUTTA Percha Tubing, being unaffected by moisture, acids, alkalies, grease, &c., is useful for the conveyance of Water, Oil, Chemicals, Liquid Manure, &c. It is peculiarly valuable for Drain and Soil Pipes. In case of any stoppage, an incision can be made in the tubing with a sharp knife, and readily closed again by means of a warm iron. Its strength is extraordinary; the small half-inch diameter tubing having resisted a pressure of 250lb. on the square inch without bursting.

Gutta Percha is totally impervious to wet, and may be steeped in water or buried in damp or marshy grounds for years. IT IS NOT SO LIABLE TO INCRUSTATION, and, from its peculiar property as a non-conductor, is not affected so soon by the frost of winter as metal piping.

The smaller sizes of the Tubing may be had in lengths of from 150 to 400 feet, and the larger sizes of 50 feet, each.

The extraordinary power possessed by Gutta Percha Tubing as a CONDUCTOR OF SOUND renders it invaluable for conveying messages from one room or building to another.

Every variety of Gutta Percha Articles manufactured at the Company's Works, Wharf-road, City-road, London; and sold by their Wholesale Dealers in town or country.

THE

JOURNAL OF GAS LIGHTING.

PUBLISHED QUARTERLY,

WITH AN INTERMEDIATE SUPPLEMENT ON THE 10TH OF EACH INTERVENING MONTH.

No. 12.] LONDON, JANUARY 10, 1850. [PRICE 1s.

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TO CORRESPONDENTS.

C. H. C. (Hamburg.)—*The December journal was duly forwarded on the 10th ult.*

NOTICES.

All communications for the JOURNAL OF GAS LIGHTING, and orders for Advertisements, to be addressed to the Editor and Proprietor, THOMAS G. BARLOW, Civil and Consulting Gas Engineer, 32, Bucklersbury, London.

The Terms of Subscription are:—

Six Shillings per Annum for the Quarterly Journal and Monthly Supplement, payable in advance.

All back numbers exceeding three months' date will in future be charged double price, unless six or more consecutive numbers are taken at the same time. The stamped editions of Nos. 2 and 4 are exhausted.

Advertisements are inserted at the rate of 5s. per six lines, and 6d. per line for all beyond, subject to the following discounts, if paid in advance:—

15 per cent. for 3 insertions.
25 ditto 6 ditto.
33⅓ ditto 12 ditto.

Subscribers who have not remitted the amount of their subscriptions are requested to do so, by Post-office order, to the Proprietor.

The Editor will be particularly obliged by his friends forwarding to him Notices of all Meetings, Trials, or Appeals which it may be interesting to the Gas World to have reported.

The usual "Circular to Gas Companies" is omitted, in consequence of the prolonged absence of the Editor, whose engagements have detained him abroad beyond the period when it is requisite that the present number should be sent to press.

Communicated Articles.

ON THE ILLUMINATING POWER OF COAL GAS.

BY ANDREW FYFE, M.D., PROFESSOR OF CHEMISTRY, KING'S COLLEGE, ABERDEEN.

In the last number of the Gas Journal Mr. Wright has favoured me with additional remarks on the observations published by me, in reply to his objections to my mode of proceeding, in ascertaining the illuminating power of coal gas. It is not my intention to offer any lengthened observations in reply to Mr. Wright: I have already dissented from his mode of attempting to prove that I am in error. He still persists in following the same method, attempting to show that the chlorine process is inaccurate, because, though it indicates the per centage of olefiant, it does not indicate that of the carbon, to which, according to him, "the whole light given by the combustion of coal gas is due, and in direct proportion to its quantity." He accordingly enters into calculations, founded on this opinion, to prove that the chlorine process cannot indicate the illuminating power. I do not agree with Mr. Wright in this opinion; but that has nothing to do with the question at issue. I have again and again given the results of trials, in which the illuminating power, as indicated by the chlorine process, corresponds with that given by the photometer. If Mr. Wright does not admit the accuracy of these results, let him prove their inaccuracy *experimentally*, by taking the illuminating power by the one mode and by the other; attending to the precaution of consuming the gases by burners fitted for each, so that each gas may be made to give forth the greatest amount of light that can be got from it, by the best methods now practised. Till he does this, I must refrain from further reply on that part of the subject.

Independent of the chlorine process, how does Mr. Wright attempt to overcome what I have stated of the illuminating power as indicated by the photometer? Here, again, he opposes me in the same way. He states that the short distance at which I place the candles from the screen "elicits another *source of error* in my experiments;" and that, consequently, "he is not inclined to put faith in photometric experiments conducted with such an apparatus." Again, I ask, why has not Mr. Wright shown, *experimentally*, that results, carefully conducted with this apparatus, do not correspond with those given by an apparatus in which the candle is 50 inches distant from the screen, as approved of by him, or even at a greater distance? Surely he is not afraid to try the illuminating power by *properly-conducted photometric experiments*, lest he should find the Scotch coals to be of superior quality to what he has found them to be by his trials with a jet of $\frac{1}{8}$ of an inch.

Mr. Wright has done me the honour to say that he considers me "an accurate and careful experimentalist." Why, then, when he does not put faith in the results of my experiments, does he not at the same time show *experimentally* that I am in error? But admitting that, in using the apparatus described, an error to the extent mentioned by Mr. Wright did occur, what, after all, does it amount to? "If," says he, "the flame of the candle should be out of the centre but $\frac{1}{5}$ of an inch, it would cause an error of six per cent." I have given the illuminating power of a gas from Lesmahago coal, of superior quality, as 12·5 candles per foot: admit the error to the extent stated, and it reduces the light to that of 11·75 candles. Supposing even that the error is doubled, still the illuminating power would be equal to 11 candles. I cannot, however, admit that my experiments were conducted so carelessly as to leave the candles so much as $\frac{1}{4}$ of an inch out of the true centre; for, aware of the objection urged, I had the apparatus so constructed, that the candle could be moved upwards and downwards, by its support being made to move in a tube, to which it was accurately fitted; and it could be pushed forwards and backwards, along with the screen, by the basement to which they were attached moving in a groove cut in a long wooden board. I am quite willing, however, to give Mr. Wright the benefit of the supposed error, and, making allowance for it, the Lesmahago coal gas to which I have referred is equal to that of 11·75 or—if Mr. Wright insists on it—of 11 candles per foot. I alluded to another gas, from another Lesmahago coal, as being equal to 8·33 candles; deducting for supposed error it would be 7·82. I maintain, therefore, that whatever Mr. Wright may say of the accuracy of the chlorine test, I have not, by the photometric process, overrated the quality of the gas from Scotch coal—at least, if I have, it is only to a very slight extent.

Mr. Wright, in his reply, makes no allusion to the hint I threw out regarding the mode of trying the illuminating power of gases by their specific gravity. Is it not worthy of notice, or has he not alluded to it because he is at present putting it to the *test of experimnet?* I trust it is the latter. And why, also, has he not adverted to the results I have given, regarding the illuminating power, when ascertained by different burners? Will he still, after what I have said, persist in affirming that by the use of a jet with an aperture of $\frac{1}{8}$ of an inch, he gets, in all cases, the true illuminating power?

Before concluding, I may be permitted to state that, since perusing Mr. Wright's last remarks, I have made numerous trials with the photometer as formerly employed, and with the candle

at other distances, and that I still adhere to the former mode of proceeding, for the following reasons:—With the candle at a short distance, there is no difficulty in fixing that at which the spot disappears, both on the one side and on the other—accordingly, on repeating the trials, I seldom varied beyond $\frac{1}{4}$ of an inch; which, when the distance between the screen and the burner is 10, 15, and with rich gases 20 and upwards, makes a very slight difference in the results. In the case of the greater distance between the candle and the screen, it is not only difficult (at least I have found it so) to ascertain the exact distance at which the spot disappears, but a still greater objection is, that it d sappears on one side before it does on the other; and hence the illuminating power will be greater or less according to the side of the screen observed. With burners consuming 4 feet of gas, from a mixture of Scotch coal, I have frequently found the difference to extend to 20 inches and more. With intense lights, when the candle is 50 inches from the screen, and when the screen requires to be 300 inches and upwards from the burner, I have found the distance at which the spot disappears, on the gas side, when the screen is moved from the burner to be 40 inches less than that at which it disappears on the candle side when it and the screen are moved forward; the screen at intermediate distances not indicating on either side the slightest change.

I consider it unnecessary to give the details of these experiments—they will be given if required—suffice it to say, that with proper precaution there was very little difference in the results; sometimes the short distances, as 4, 5, $6\frac{1}{2}$, and 10 inches, gave a higher, at other times a lower, illuminating power than the greater distances, as 25 and 50 inches, the difference sometimes amounting to $\frac{2}{10}$ or $\frac{4}{10}$ of a candle, when the gas burner was giving the light of about 20 candles; on one occasion it amounted to 1 candle: thus making the difference to vary from two to five per cent.; being sometimes in favour of the one mode, sometimes of the other. With regard to long distances I may, however, give the result of one trial showing the uncertainty of this mode of proceeding. The candle was 50 inches from the screen; the gas burner was consuming gas to its full extent. On moving the screen and candle backwards, the spot was just observed at 130 inches—it did not entirely disappear till the distance was 131 inches; on moving still farther back, the spot on the candle side did not appear till the distance was 184 inches; and again, on taking the screen farther back, and again bringing it forward, the spot on the candle side appeared at 184, but that from the gas side did not appear till the screen came to 131 or nearly so. How are we in this instance to fix the illuminating power if by the disappearance of the gas side spot, it is equal to 6·25 candles, while by the other, it is equal to 13·54? I presume that the only way is to take the mean distance between 131 and 184, and thus make the illuminating power 10·19. Hence, then, the absolute necessity of observing the screen on both sides. I have often heard this brought forward as a great objection to the use of the screen. I do not find it applicable when the candle is at shorter distances, the spot on both sides disappearing at the same time, or very nearly so. There is another advantage attending the use of short distances. The trials formerly recorded were conducted in a small room, the walls of which were plastered, but not painted. I presumed that, as the reflection was the same from all sides, the effect on both sides of the screen would be the same. To satisfy myself that there was no error arising from this source, I have again repeated some of the trials, taking care to avoid any error from reflection. For this purpose I placed the screen and candle in one room, the gas-burner in another, and allowed the light from it to pass to the screen by a small opening at the door. If in this case there was any reflection it was from the candle, and, being greatest from the wall nearest to the candle, it would, of course, be in its favour: but there must have been very little, because the room was large. The average of different trials in this way corresponded with those given by the former mode of operating. When the lights were in the same room the illuminating power was, on an average of numerous trials, 19·7. When they were in different rooms it was 19·89, thus proving that there was no error from reflection in the former mode of proceeding.

In conducting these and the other experiments to which I have now alluded I took the additional precaution of having a plumb-line suspended between the gas burner and the screen, and also between the screen and the candle, while at the same time a perpendicular was raised over the centre of the spot. I had thus five points of observation, viz., the centre of the gas flame, the plumb-line, the centre of the screen spot, the plumb-line, and the point of the candle-flame, all of which were brought to be in the same line, thus securing that the flames were in the true centre.

It is for the reasons now assigned that I prefer a short distance between the candle and the screen, say four, five, or ten inches,* of course taking the necessary precautions to have the flames in the true centre, and the apparatus as nearly as possible in the centre of the room, to avoid error from reflection. I have heard it proposed to have the walls blackened. I have no objection to this; but, under proper precautions, I do not think it necessary.

Before concluding, I may again advert to the illuminating power of the gas from Scottish Parrot coal: that on which I performed the trials now recorded was prepared from a mixture of Lesmahago coal and another known to be of inferior quality. The condensation by chlorine was 12; the durability by a five-inch flame, from a jet of $\frac{1}{35}$ of an inch, was 1 foot in sixty-six minutes. It was, therefore, below the average quality of gas supplied to towns in Scotland. Taking the average of the photometric trials with the candles at various distances, from 4 to 50 inches from the screen, and conducted with the precautions mentioned to secure accuracy, one cubic foot per hour was found to give the light of 5·12 candles. According to Mr. Wright the English gas that he used was, by his mode of operating, equal to 1 candle per foot; Lesmahago coal gas was equal to 2·33 candles. My gas, which was got from a mixture of Lesmahago and an inferior coal, and consequently inferior in quality to gas from Lesmahago alone, gave the light of 5·12 candles per foot: more than double of that given by Mr. Wright's process with Lesmahago gas.

I cannot see how any one can call in question the accuracy of these results, which correspond with those stated in my former paper. I maintain, therefore, notwithstanding what Mr. Wright has asserted, that I have not overrated the illuminating power of the gases from Scottish Parrot coal; and still further, I maintain that the chlorine process, taking durability also into account, is a true indication of the illuminating power, and this I must hold to be true till it is shown *experimentally* to be otherwise.

I have again to thank Mr. Wright for the remarks he has made; at the same time, however, I have to state that I shall not again reply to any observations he may make, *founded merely on opinions* he may entertain regarding the source of light. Whatever that may be, I have asserted that the condensation by chlorine, along with durability, is a true indication of the comparative illuminating power of coal gases. I have, I think, proved the truth of this by photometric experiments, conducted with every precaution to avoid sources of error. If Mr. Wright, after what I have now recorded, still persists in asserting that I am wrong, let him repeat my trials with properly constructed burners, so that each gas shall be properly consumed, using the candles at various distances, and, if adopting long distances, fixing that at which the spot disappears on both sides of the screen, and taking the mean. Let him then contrast his results thus obtained with those which he obtains by the chlorine process. If in this way he proves, experimentally, the inaccuracy of my mode of proceeding, then I will abandon it—but not till then. But, again, the accuracy or inaccurrcy of the chlorine process has *now* nothing to do in the dispute; it is not now whether it is complete or not; the question has *now* assumed a more serious character. Have I overrated the quality of gas from Scottish coal? I have given the illuminating power, as indicated by *photometric experiments*, and to these I adhere till overturned, *experimentally*, by others.

I have to apologize for having taken up so much space in the Journal; I hope, however, that the dispute carried on by Mr. Wright and myself—I trust also in good feeling on both sides—will result beneficially to others engaged in similar researches. If so, I do not regret that it has occupied so much of my time.

In conclusion permit me to say, that should Mr. Wright visit the North, it will afford me much pleasure to meet him. I trust that he will find our regions not no sterile as he thinks them, and that he will take away a better impression of the people than he has of the coals; but even of these I feel satisfied that, if I had him here, I could make him have a higher opinion of our gas than he seems inclined to have.

REPORT MADE TO THE COMMITTEE OF MANAGEMENT OF THE CITY OF LONDON GAS COMPANY, BY THOMAS G. BARLOW, C.E.

Your secretary has communicated to me your request that I should carefully consider the case of the Great Central Gas Consumers' Company, as stated in the evidence given by their engineer before the parliamentary committee of the last session, and detailed in the prospectuses and documents which have since been issued by them, with a view of qualifying myself to advise you as to the course which, upon a mature and impartial consideration of the question in all its bearings, I should recommend you to adopt, having due regard to the public interest and your own reasonable expectations of remuneration for the capital you have invested.

The task imposed upon me is a difficult one, as the case of the Great Central Company closed without your having an opportunity of rebutting its many misrepresentations and exaggerations; and I am, therefore, left to my own experience and observations alone, unaided by that of men more known and of greater weight than myself, to lead the way in a critical examination of a project which has now been for some time before the public, and what its promoters have announced to have been satisfactorily proved before a committee in the House of Commons, on the *ex parte* evidence of its projectors. I approach the subject, therefore, with a due sense of its importance and of the disadvantages under which I labour, but with a determination not to misrepresent or undervalue anything, but faithfully and fairly, and as a disinterested and impartial inquirer, to allow to every argument and statement its full weight, and to every fact its full value.

The course I propose to follow in this inquiry is, in the first

* I observe that, in the number for October, second column, it is stated that the distance between the candle and screen may be ten *feet*—it should be ten *inches*.

place, to examine Mr. Croll's estimates of the cost of construction, and afterwards those of production; following generally his lucid arrangement of these accounts, admitting his figures—so far as I am able—and correcting them where I dissent; stating, however, my reasons for so doing.

But, before going into the subject generally, I must first trouble you with a few remarks upon one of the most plausible arguments of the advocates of the measure, which has, I believe, had some influence with the public, though when more closely examined will be found to be untenable, and will, therefore, be most conveniently disposed of at once. This argument is that, as the city of London covers only one square mile of surface, and the surrounding districts lighted by gas cover 65 square miles, the price of gas in the city of London should be 33 per cent. lower than in the out-districts, because a much larger quantity is sold within a comparatively limited space. If, however, it should be found that the cost of the main pipes used in the supply of the City with gas, is as many times greater than the average cost of the main pipes laid in each square mile of the out-districts as the quantity of gas consumed in the former exceeds that of the latter, then both are, in this respect, upon an equality; and, as cause will exist for any difference in price, *surface* has really nothing to do with this question, which resolves itself into that of the ratio of the capital invested to the revenue derived. I do not mean to assert that the out-districts are upon a *perfect* equality with the City in this respect, but my experience leads me to believe that the advantages resulting to the latter, have been grossly exaggerated, as the following facts will prove.

The total quantity of mains laid in the 66 square miles forming the area of the metropolis is, in round figures, 2400 miles; their average area being 20 square inches. Of these, however, 900 miles are duplicate mains, laid in districts where there are two or more competing companies; so that the actual length of streets and public thoroughfares lighted by gas is 1500 miles, including 110 miles of mains laid in the City, of which about 35 miles are duplicate mains. The streets lighted in the 65 square miles of the out-districts are consequently 1425 miles in length, and in the one square mile of the City 75 miles in length. Mr. Croll's project contemplates the laying of 80¾ miles of mains, of an average area of 47 square inches, so that the 75 miles of streets lighted in the City, are equal, from the increased calibre of the mains, to 176 miles of streets lighted in the out-districts, taking even Mr. Croll's figures as the basis of my calculation (though I shall show afterwards, that the mean area of a system of pipes for distributing the quantity of gas which he proposes to supply from one station, should not be less than 70 square inches). We thus ascertain that the ratio between the mains laid in the square mile of the City and the 65 square miles of the out-districts is as 1 to 8·09; but as mains of large calibre cost less, in proportion to their capacity, than small ones, the ratio of structural value will be as 1 to 10; and $\frac{1}{8}$ of the total quantity of gas made in the metropolis is consumed in the City; consequently $\frac{1}{10}$ of the total capital invested in the main pipes of the metropolis is *expended* in the city of London; and $\frac{1}{8}$ of the revenue derived from the sale of gas is *earned* therein.

It may be objected that in these calculations I have excluded the 900 miles of duplicate mains; to which I reply, that, as there are districts where competition exists, and others where it does not exist, all comparisons must be founded on a uniformity of basis; and, if we admit the existence of competition on any point, we must calculate upon its existence everywhere, doubling the 1425 miles of streets lighted in the out-districts, and adding 110 miles to the mains laid in the City, so that my argument will hold good, though the proportions may be slightly varied.

I have been anxious to establish these facts before going into the details of the general question, believing that gas companies in general, as well as the public, have long had an impression that a large demand for gas over a limited surface, did not involve an expenditure of capital at all commensurate with the advantages derived from such a position. These advantages I have proved to be inconsiderable, so far as the cost of establishing works is concerned. The principal economy being in a diminished leakage of gas, the capacity of the City mains being treble that of the out-districts, whereas the leaking surfaces are scarcely doubled, and the leakage at the joints is materially diminished.

I will now proceed to an analysis of the case of the Great Central Company, commencing with the estimate of the cost of constructing and carrying on a gas work manufacturing 368,000,000 cubic feet per annum, the maximum quantity of 1,800,000 cubic feet per day.

It is announced that sufficient land for a manufacturing station has been purchased, at an expense of £5000, two miles eastward of the City, and that a gasholder station is to be established close to the City boundary. Provision must, therefore, be made for the transmission of 75,000 cubic feet of gas per hour from one station to the other, which may be effected, at a cost of £8142, by a 24-inch pipe, on a level free from sharp angles and curves, with a loss of pressure of $\frac{5}{10}$ of an inch between the points of supply and delivery.

The land for the gasholder station may possibly be obtained for £5000 additional, making £18,142 as the total cost of land and the pipes connecting the two stations. This plan will certainly be less costly than that of erecting the gasholders at the manufacturing station and laying four lines of 26-inch pipes, which would be required for the transmission of the maximum hourly consumption of 350,000 cubic feet (the quantity required to be supplied from dusk up to seven o'clock in the evening, if the daily consumption should reach 1,800,000 cubic feet), the cost of which would be at least £35,000.

The most prominent feature of the whole project is the adoption of a modification of Messrs. Lowe and Kirkham's patent for heating clay and iron retorts from the same source of heat. The system of the original inventors is to set both descriptions of retorts in one arch or oven, the clay retorts receiving the first heat and the iron ones the expended heat. Mr. Croll's object is the same; but he carries the system further, by placing clay retorts alone in one arch or oven where the heat is generated, and iron retorts in a distinct arch or oven beneath, into which the surplus heat escaping from the upper arch or oven is conducted, in the expectation that the temperature would prove sufficient for the economical distillation of coal in the iron retorts. The advantages of the successful adoption of such a system would be—

1st, Economy in the cost of construction of the retorts and buildings to receive them.
2nd, Economy in fuel.
3rd, Economy in labour.
4th, Economy in wear and tear.
5th, An increase in the quantity of gas made from each retort.

And Mr. Croll states these advantages to be such as will reduce the cost of gas delivered into the gasholder to 1s. 4·67d. per 1000 feet, a price nearly 30 per cent. less than it is now produced at by any of the metropolitan companies.

My first step has, therefore, been to obtain precise and certain information as to the practical working of the system in those places where it has been tried; and from the reports I have received I find that the average working of such retorts with Newcastle coals has been from 4 to 4½ cwt. of coal per day per retort, yielding 1868 cubic feet of gas at Mr. Croll's average of 9200 feet per ton, instead of 4000 feet, and that the fuel has been 31·2 per cent. instead of 20 per cent. It must also be borne in mind that the 20 per cent. of fuel was stated to include the coke used for getting up the heats of extra retorts, for slow fires under retorts for which there is not full occupation, engine-boiler, offices, workshop, &c.; none of which are included in the 31·2 per cent., and would certainly have augmented it to 33⅓ per cent., or one third of the total quantity of coke made, instead of 20 per cent., or one fifth.

I must confess that these unfavourable results astonished me much, as I was prepared to expect a nearer approximation to the statements which had been so confidently put forward. The theory of such a system of retort-setting is unobjectionable; but it seems to be demonstrated by practice, that the heat is so wire-drawn and exhausted in its descent into the lower chamber, as to render the temperature insufficient for the distillation of coal with advantage. For this purpose a sharp brisk heat is required, especially at the commencement of the charge; and, though in the most approved and successful modes of retort-setting, a large portion of the caloric escapes and is lost, yet I doubt whether much of it can be beneficially applied to the distillation of coal in cast-iron retorts of the usual construction.

Instead, therefore, of 504 retorts set upon such a principle, being capable of producing the maximum daily quantity of 1,800,000 feet of gas, it would require 960 retorts to be actually heated and in operation, without any allowance or reserve in case of accident; which reserve should not, in my opinion, be less than 15 per cent., or 144 retorts, making a total of 1104 retorts, for which provision must be made.

These figures were startling even to myself, because I knew that with 700 12½ iron retorts, the maximum quantity of gas of the best quality may be produced; but I cannot alter facts; and, feeling assured that the most implicit reliance may be placed in the above-mentioned report of the working of the system which Mr. Croll proposes to adopt, I have no alternative, should that system be adhered to, but to take 1104 retorts as the basis of my future calculations. I apprehend, however, that upon mature consideration, and after duly weighing the unfavourable result attending the trial already made, that the promoters of the new company will abandon their intention of adopting this peculiar arrangement of retorts, and make further inquiries as to other systems and their working. Messrs. Lowe and Kirkham's original plan, or the Scotch system of clay retorts alone, and the London one of cast iron alone, as well as the Liverpool retort—partly of cast and partly of wrought iron, have each their several advantages, depending upon the nature and cost of the coals used, their products, and the prime cost of the retorts themselves.

I conceive, therefore, that I should be committing an injustice against the common sense of the business gentlemen composing the board of the Great Central Gas Company, in presuming that they will adhere to any speculative plan involving the erection of 1104 retorts, where 800 on a more tried system will suffice; and I shall, therefore, adopt the latter number as the basis of my calculation of the cost of the works and the expenses of production, assuming one half of them to be clay retorts and one half iron,

and leaving it to further experiment to determine which description is found best in practice.

Mr. Croll's estimate of the average cost per retort set complete, ready for action, is nearly £15, but as it is evident that his arrangement is less expensive in first cost, inasmuch as the retorts occupy half the superficial space, and consequently require less foundation and contain less brickwork than any other system, a departure from it will necessarily augment the expense. A carefully-made estimate gives £17. 15s. as the cost per retort on Messrs. Lowe and Kirkham's plan, and £19 as the cost of iron retorts exclusively, where no iron stage floor is used; but following out my assumption, that half of the retorts are clay and half cast iron, I take the mean average of £17. 15s. each.

The sums allowed for the condensers, purifiers, and general connections may possibly be sufficient to cover their cost; but those set down for the tanks and gasholders are very much too low; and my experience in constructions of this nature has been varied and extensive. The estimate is a fraction under 3d. for each cubic foot of content, while I confidently affirm that no gasholders of similar dimensions, with brick tanks, have been erected for less than 4⅜d. per cubic foot, or with iron tanks for less than 5½d. per cubic foot. If the contract for the three gasholders and tanks was given out to the same contractor to be executed at the same time, a small saving on these rates might possibly be effected; and if I allow 4½d. per cubic foot for a gasholder with a brick tank at the manufacturing station, and 5d. for two gasholders and iron tanks with puddled clay bottoms at the gasholder station, I believe I shall have placed them at the lowest possible cost. I might criticise the mechanical details of their proposed structure, and show the danger of trusting to machines so constructed: but this would be, perhaps, entering into an unnecessary detail, and I merely notice it to protect myself from being considered to have approved of the design.

Mr. Croll asserts that the main pipes, of which a detailed list was handed in by him, are of a sufficient capacity, not only to pass 1,800,000 feet per day, but *double this quantity*, or 3,600,000 feet. His plan provides for one mile of 24-inch pipes between the manufacturing and the gasholder stations, and another mile into the heart of the City; these being stated to be of sufficient capacity for the distribution of the first 1,800,000 feet, and when the demand exceeded this quantity a duplicate 24-inch main is to be added. I must dissent most completely from Mr. Croll's assertions as to the capabilities of the above-mentioned mains for the transmission of anything approaching the respective quantities that he states.

A maximum daily supply of 1,800,000 cubic feet of gas in the city of London requires the delivery of 350,000 cubic feet per hour, between the hours of five and seven o'clock: to convey which to a distance of one mile from the gasholder station, with a loss of $\frac{5}{10}$ pressure, one main of nearly 52 inches diameter, or four mains of 26 inches diameter, would be required. My experience as to the flow of gas through mains of large diameters has established the fact, that for each square inch of area the quantities of gas of a specific gravity of ·400, flowing through a pipe of one mile in length, under different pressures, will be as follows:—

$\frac{5}{10}$	loss of pressure	166 feet per hour.
$\frac{6}{10}$	do.	182 do.
$\frac{7}{10}$	do.	197 do.
$\frac{8}{10}$	do.	211 do.
$\frac{9}{10}$	do.	223 do.
$\frac{10}{10}$	do.	236 do.
$\frac{16}{10}$	do.	289 do.

These quantities multiplied by the area of large pipes, in inches, will give the hourly quantities of gas they are capable of transmitting under the different pressures. These calculations agree exactly with facts, as may be proved by your own experience, and that of the Chartered Gas Company at their Westminster station; that establishment is very nearly similar in scale to that of the intended Great Central Company: the former making 350,000,000 cubic feet of gas per annum, or 1,750,000 feet per day, and delivering 200,000 feet per hour; and the latter proposing to make 368,000,000 feet per annum, or 1,800,000 feet per day. Both stations are situated on the extreme verge of their districts, and, for all practical purposes, may be put in comparison with each other. In one respect, however, a West-end gas work differs from a City one; and this is in the hourly rate of consumption in the former, being nearly equal up to nine o'clock; whereas in the City, the consumption begins to diminish at seven o'clock, from the closing of offices and wholesale warehouses. A City gas work making the same daily quantity of gas as a West end one, is therefore, called upon to deliver a larger maximum quantity per hour, and must be provided with mains of a larger capacity.

The outlet mains of the Westminster station present a total area of 1143 square inches, being equal to one main of 38¼ inches diameter, or nearly to two 24 inches and one 18 inch. They consequently pass 175 cubic feet of gas per hour for each square inch of their area; the average working pressure being $\frac{7}{10}$, from which deduct the average pressure of $\frac{2}{10}$ at one mile distant, gives an effective moving force of $\frac{5}{10}$. By calculation the delivery should be 182 feet, a difference too trifling to be worthy of observation.

Your own maximum delivery of gas per hour up to seven o'clock may also be estimated at 200,000 feet through outlet mains, presenting a total area of 1361 square inches, or 147 feet of gas per square inch, the pressures varying from $\frac{8\cdot2}{10}$ to $\frac{8}{10}$, but of which the mean difference between the extremities of the pipes at one mile from the works may be taken at $\frac{4}{10}$.

I could cite many other instances in corroboration of my statements, but the above can be so easily verified that I will rely upon them.

Mr. Croll's single line of 24-inch main, from the gasholder station into the heart of the City, is unequal to the transmission of more than 75,000 feet per hour, with a loss of $\frac{5}{10}$ pressure; and by augmenting the pressure to $\frac{10}{10}$ it will only deliver 106,000 feet out of the 350,000, for the passage of which mains must be provided. It would occupy too much time to lay down a general scheme of mains for the distribution of 350,000 feet per hour in the city of London; but I submit I have stated enough to prove that at least the whole four miles of 24-inch main provided for by his estimate must be laid down in the City, and the mean calibre of 47 square inches provided for by him must be augmented, so that the mean area of the whole shall be increased to at least 70 square inches. My reasons for this opinion are that the City is now supplied with gas from *three* stations, all of them situated at three different points of its circumference; the mean area of the mains supplying your section being 34 square inches, and of the other two sections 38 square inches; which, added together, give a mean area of 72 square inches of mains, if the whole supply was derived from one station.

Mr. Croll's provision for lighting the City comprises 142,120 yards, or 80 miles 6 furlongs, thus distributed:—

7,040	yards	24 inch.	
5,133	„	18 „	
2,959	„	14 „	
9,132	„	10 „	
4,470	„	8 „	
1,822	„	7 „	
2,496	„	6 „	
5,242	„	5 „	
16,226	„	4 „	
9,306	„	3 „	
35,994	„	2 „	
42,000	„	2 „	in the smaller courts.

Total, 142,120 yards, of which the mean area is 47 square inches, or 7¾ inches mean diameter, the estimated cost being £65,016, or 9s. 1d. per yard run laid complete. As, however, I have shown that a mean area of 70 square inches, or 9½ inches diameter, will be required, the cost will be increased to 12s. per yard, or to £85,272, being an excess of £20,256 over the estimate.

I have yet to add the cost of 8515 private service pipes, and the expense of connecting 2678 public lamps, to complete the estimate of the mains and services.

One of the most serious errors in the estimates is the allowance for meters. The quantity of gas to be sold, after deducting the 51,196,000 cubic feet presumed to be consumed by the public lamps, is 255,470,667 cubic feet, for which 3000 meters are provided, being at the rate of 85,175 for each meter. I find, upon the examination of your own accounts, that each meter in your district registers only 34,083 feet per annum, including the Post-office and other large establishments, whose great consumption tends to swell the average; and as I have before me the accounts of another metropolitan gas company, where 10,000 meters are required for the distribution of 190,000,000 feet per year, or 19,000 feet per meter, I apprehend that I shall not be justified in estimating that more than 30,000 feet of gas will be sold in the City for each meter fixed. This will increase their number from 3000 to 8515, and their cost from £7500 to £21,287. 10s.

To the estimate of the preliminary expenses of £8000 I add the £4000 already expended in the application made last session of Parliament, a statement of which has been issued by the directors and circulated among the shareholders.

The last important error in the capital account to which I shall call your attention is the item of working capital. The earnings of a gas work being collected quarterly, a sufficient fund must be provided, not only for the payment of a winter quarter's expenses, but also to cover the arrears which invariably attend the carrying on of a trade of this nature, and for the floating working stock. I have found in practice that, where credit is not taken, the working capital must be equal to *half a year's gas rental*, and the items of which it is composed would be constituted as follows in an establishment of the magnitude of the one in question:—

10 per cent. arrears of rental	£6,133
10,000 tons of coal in stock	8,000
Stock of meters and service pipes	1,000
Ditto retorts, fire goods, and materials for repair of apparatus	2,500
Stock of coke, breeze, and tar	1,500
Wages of stokers, barrowmen, coke-fillers, &c. ..	2,022
Three months' wages to engine-men, purifying-men,	
Carried forward	£21,155

	Brought forward			£21,155
valve-men, superintendent, foreman, gatekeeper, storekeeper, and coke clerk				573
Three months' wear and tear of retorts				970
Ditto ditto works and mains				766
Ditto ditto meters				532
Three months' maintenance of works				700
Ditto wages to lamplighters				500
Ditto salary to collectors				307
Ditto rates and taxes				975
Ditto stationery and incidental expenses				300
Ditto salary of directors				500
Ditto engineer, secretary, clerks, and inspector ..				750
Ditto lime				300
	Total			£28,328

or say, in round figures, £30,000, to provide for a balance at the bankers.

The accompanying table (No. 1) contains a corrected summary of Mr. Croll's estimate of the capital required for constructing and working a gas work for the production and distribution of 368,000,000 feet of gas per annum, amounting to £272,299; and it now remains for me to show what will be the expenses and revenue of such an establishment, the selling price of gas being 4s. per 1000 feet.

The estimate for coals I admit to be sufficient; but that for labour is far too low. The allowance of 3½d. per 1000 feet is based upon the supposition that each retort will yield 4000 feet of gas per day, and that 250 retorts would be required for the mean daily production of 1,000,000 feet. I have, however, already shown that the yield of each retort, set on Mr. Croll's system, is only 1868 feet per day; at which rate 590 retorts would be the mean daily average. My calculations are, however, based upon the supposition that 400 will suffice, the annual cost in labour of working which, will be as follows:—

Superintendent of manufacturing station ..		£200	0	0
Two foremen at ditto ..	36s. per week	187	4	0
Four foreman stokers ..	30s. „ ..	312	0	0
Sixty ordinary ditto { 30 by day / 30 by night }	24s. „ ..	3744	0	0
Barrowmen for wheeling coal, 40,000 tons at 3d.		500	0	0
Coke-fillers, by contract, at 6d. per chaldron, including breeze		746	13	6
Labourers delivering tar and ammoniacal liquor ..		160	0	0
Two engine-men	42s. per week	218	0	0
Two assistants and fireman	24s. „	124	16	0
Six purifying-men ..	24s. „	374	8	0
Two valve-men at manufacturing station,	28s. „	148	4	0
Storekeeper and assistant		220	0	0
Two coke clerks		200	0	0
Gatekeeper		78	0	0
One foreman at gasholder station	36s. per week	93	12	0
Two valve-men ditto	28s. „	148	4	0
Total		£7455	1	6

or 4·86d. per 1000 cubic feet.

Wear and tear of retorts is set down at 2d. per 1000 feet, which low rate is assumed as resulting from the long duration and large production of gas by retorts set on Mr. Croll's new system. Experience has not sufficiently developed the merits of the invention with respect to the *increased duration* of retorts; but Mr. Croll admits in his evidence that each cast-iron retort, weighing 16 cwt., and of a value of £5, and each clay retort of the value of £3. 10s. (both prices being the first cost of the retort without setting), ought to produce 700,000 feet of gas; in which statement I confirm him. This is a base upon which we agree as the foundation for a more detailed calculation:—

368,000,000

700,000 gives 526 as the annual admitted destruction of retorts in such an establishment; the cost of which, where clay and iron retorts are used, will be—

263 iron retorts, at £5 each	£1315	0	0
263 clay ditto, at £3. 10s. each	920	10	0
Taking down 526 old retorts, breaking the connections, and the removal of old materials	105	4	0
Bricklayers' wages resetting 526 new retorts ..	328	15	0
Clay and fire goods used in resetting retorts, and in repair of furnaces.	526	0	0
Making good connections to hydraulic main ..	78	18	0
Bolts and cement for new connections, wear and tear of ashpit pans, furnace doors and bars, ears and crossbars, barrows, scoops, shovels, brooms, &c.	263	0	0
Allowed 10 per cent. for accidents and defective retorts	353	14	0
	£3891	1	0

or 2·53d. per 1000 feet, which is a very low estimate, more especially with respect to clay retorts; the lowest price, delivered in London, which I have yet seen from any respectable manufacturer of these articles being £4. 4s., if made in one piece. Although in the above calculations I have almost adopted Mr. Croll's figures, I must guard myself from being presumed to advocate the adoption of Messrs. Lowe and Kirkham's system of setting retorts. It has now been before the gas world for some years, and both of these gentlemen occupy positions which would, doubtless, have induced the principal metropolitan gas companies to have adopted their system, had they been able to demonstrate that under it the wear and tear of retorts could be reduced to the low figure of my present estimate, instead of continuing to use iron retorts at a cost of 4d. per 1000 feet, and upwards.

A bushel of unslacked lime, used in the wet state, will purify 25,000 feet of gas, on which basis I have made my estimate. The removal of the refuse lime is a costly operation, which is omitted in Mr. Croll's estimate.

Wear and tear of works and mains I have taken at his estimate, though I consider it far too low for works that have seen any service.

I come now to consider the saleable products of the coal distilled; and having already shown that the allowance of 20 per cent. for fuel ought to have been 31·2 per cent., *exclusive* of coke used for getting up the heats of extra retorts, slow fires, engine boiler, offices, workshops, &c., and 33⅓ per cent., *including* these charges, I have only further to remark that the sale of large quantities of coke in thinly-populated districts, is attended with great difficulty, and can at certain periods of the year only be forced by great sacrifices in price. In estimating the average return for coke at 10s. per chaldron, I think Mr. Croll takes too high an average for a locality such as the site of his intended works; between which and the populous districts there exists the Commercial, British, and Ratcliffe Companies as competitors, having already possession of the coke market, which I am convinced will not bear so large an increase in the supply, without materially diminishing the price; and, instead of 10s., I believe 9s. would scarcely be realized.

Breeze may be had at most of the London gas works at 3s. per chaldron, and of some at 2s. 6d.; possibly, however, the vicinity of brickfields may cause it to be saleable at 3s.

Making these corrections, I find that the lowest possible estimate of the prime cost of gas as measured at the station meter is 1s. 8·64d. per 1000 feet; which, however, may be increased to 1s. 10·11d., should the use of clay and iron retorts prove to be a failure. I proceed now to the expenses of distribution.

Mr. Croll estimates the lighting, cleaning, and repairing the public lamps at 15s. each. The actual cost to you is 18s., which is about the average cost.

Collection and bad debts are estimated at 2 per cent. on the rental. Bad debts alone, in districts where competition exists, usually amount to 3 per cent. on the rental; and, in allowing this per centage for collection and bad debts, I think I am striking a fair average.

Rates and taxes are acknowledged to have been guessed at; and having had much experience in appeals against exorbitant assessments on gas works, and being well acquainted with the practice of quarter sessions and the decisions of the superior courts on these questions, I venture to affirm the net rateable value of such an establishment would not be less than £13,000 per annum,—the various rates in the city of London payable upon which, viz., poor-rate, tithe, consolidated, police, and ward rates—amounting on an average to 6s. in the pound—give £3900 a year as the expenditure under this head.

The law expenses of a gas company are very uncertain. An appeal case, an accidental explosion, or damage to a neighbour's property, are often very costly, for which £300 a year is a very inadequate provision, and if augmented to £500, as I have done in my estimate, will scarcely be sufficient.

The allowance for stationery and incidental expenses, directors, engineer (the last two items being higher than those of any similar gas company with which I am acquainted), clerks, inspectors, and maintenance of works, I will take at Mr. Croll's figures, though it must not be understood that I consider the last as adequate for the object. Some of the items however being liberal, I am willing to set the excess of one against the deficiency of the other, and be content with the average.

Wear and tear of meters, and the expenses attendant upon their gratuitous use, cannot be estimated at less than 15 per cent. on their prime cost; and I doubt whether any meter manufacturer would take it at this rate. The expenses of gas companies which let meters out to their customers on hire at 10 per cent. considerably exceed the revenue derived from them.

Mr. Croll estimates the leakage and gas unaccounted for, at ⅛ of the total quantity of the gas made, although; while in the service of the Chartered Gas Company, he placed it publicly on record that it was sometimes 30 or 40 per cent: a statement which I confirm. I have however before admitted, that diminished leakage was the principal advantage of a limited district, where the consumption of gas was large and the mains of great capacity, in comparison with their leaking surfaces; but whether the advantage of such a condition is to the extent which Mr. Croll now states, I have considerable doubt; though, for the sake of argument, I will admit the lower proportion as existing, reserving to myself the liberty of

modifying this opinion, should I, on further investigation of the facts of the case, find myself compelled to do so.

The balance-sheet of the production account, thus corrected, shows a profit of £8921 applicable to dividend, being a trifle less than 3¼ per cent. on the capital employed; but, if the capitalists investing their funds in such operations depend upon receiving 10 per cent., then must the price of gas to the private consumer be increased from 4s. to 5s. 5¼d. per 1000 feet, as the whole of the profit beyond 3¼ per cent. must be extracted from the private consumer alone, it being agreed that the public lamps shall not be advanced beyond their present rate. The promoters of the present scheme have committed the double error of under-estimating the outlay of capital required, and the cost of carrying on such an establishment. These errors are augmented, by the presumption that the existing companies will quietly submit to be despoiled of their property, and allow the new comers to sell 255,000,000 cubic feet of gas, without making any effort to retain their customers, in which expectations they will doubtless be disappointed, though it may be too late to prevent the consequences of their errors. There is no instance on record in which a gas company competing with an old-established company, conducting its business liberally and fairly, has not in the end compromised with them on terms disadvantageous to the public; and, though in this instance, such result is hoped to be avoided by the introduction of a new condition, viz., that a maximum price of 4s. shall be fixed by act of Parliament, yet it is not difficult to foresee a state of things which may prevent such a company from being in a condition to fulfil its engagements. I am confident that no gas work on the scale proposed, can be erected and worked in London with a less capital than I have estimated; and I defy any one to quote a solitary instance where such works have been newly constructed in this country, and carried on, except with a capital 60 per cent. greater than Mr. Croll's estimate. On these points you will no doubt consult other impartial engineers, whose names and experience may perhaps have greater weight than my own; and counterbalance the effect which the long silence maintained on the subject of these estimates, may have produced on the public mind.

The evidence I have brought forward, and the argument to be drawn therefrom, prove that gas at 4s. per 1000 feet will yield only 3¼ per cent. on the capital invested in a new gas work for the city of London; presuming, (a thing impossible) that you will quietly surrender your trade. No one will, I think, admit that this is an adequate remuneration for your skill and enterprise; but still it becomes a question whether you shall not accept it, rather than encounter a ruinous opposition, which can only end in the exhausting of the capital of your opponents, and the loss of a portion of your own. The position is a grave and difficult one; but, on mature consideration of the question in all its bearings, I should advise you to propose to the Commissioners of Sewers a reduction in price to 4s. per 1000 feet when the quantity you sell by meter shall have reached 240,000,000 feet; and in the meantime to lower it from its present price by 3d. per 1000 feet, for each 10,000,000 feet you sell by meter, exceeding 200,000,000, so that when the consumption exceeds

200,000,000	the price will be	4s. 9d.	per 1000 feet.
220,000,000	ditto	4s. 6d.	ditto.
230,000,000	ditto	4s. 3d.	ditto.
240,000,000	ditto	4s. 0d.	ditto.

Mr. Croll's calculations are all based upon an estimated scale by meter of 255,000,000 feet; and the adoption of my recommendation assures the public that his price of 4s. would be arrived at, when the sale is 15,000,000 less. The sudden and immediate reduction to this price, with your present consumption, will leave you almost without profit: a position which I think the Commissioners of Sewers will not, upon a fair representation of your case, force you into submitting to.

TABLE No. 1.

ESTIMATE of the Cost of a Gas Work in London capable of producing a maximum quantity of 1,800,000 cubic feet per day, or 368 million feet per annum.

Ground Purchase and Connecting Mains between the two Stations:			
Land for manufacturing station		£5,000 0 0	
Two miles of 24-inch mains, as per Mr. Croll's estimate	£7,878 0 0		
Paving	264 0 0		
		8,142 0 0	
Land for gasholder station		5,000 0 0	
			£18,142 0 0
Buildings:			
Retort-houses for 800 retorts, 52 feet span, 640 feet long, and 24 feet high, covered with slated iron roofs		16,640 0 0	
Coal-stores to contain 10,000 tons of coal, covered with slated wooden roof		9,000 0 0	
Purifying-house, covered with slated iron roof	1,800 0 0		
Iron beams and flooring for do.	380 0 0		
		2,180 0 0	
Chimney, 120 feet high, with flues lined with fire-bricks		450 0 0	
Tar and ammonia tanks, as per Mr. Croll's estimate		497 0 0	
Evaporating-tank, do.		100 0 0	
Carried forward		£28,867 0 0	£18,142 0 0
Boundary walls, manufactory		700 0 0	
Do. gasholder		450 0 0	
Superintendent's and foreman's residence		750 0 0	
Offices and workshops, valve and meter house at manufactory		1,500 0 0	
Valve-house, ane foreman's residence at gasholder station		350 0 0	
Plant, &c.		£32,617 0 0	
800 Retorts, viz., 400 clay and 400 iron, with mouthpieces, ascension pipes, hydraulic mains, &c., set complete, at £17. 15s. each		14,200 0 0	
Condenser, as per Mr. Croll's estimate	1,237 10 3		
Foundations, as per do.	5 11 0		
		1,243 1 3	
Purifiers, as per do.	1,117 16 0		
Brick piers for do, as per do.	44 0 0		
		1,161 16 0	
General connections, as per do.		561 2 6	
Station-meter, governor, and pressure registers, complete, as per do.		1,250 0 0	
Steam-engine and exhauster, complete, as per do.		1,150 0 0	
Valves, as per do.		290 16 0	
Tools, as per do.		1,034 6 5	
Superintendence, plans, &c., as per do. (surveyor's commission)		1,000 0 0	
Total Manufacturing Plant and Apparatus			54,508 2 2
A brick tank, with gasholder, containing 412,000 cubic feet, to be erected at the manufactory		£7,725 0 0	
Two iron tanks, having puddle bottoms, with gasholders, containing 824,000 cubic feet, to be erected near the City boundary		17,166 13 4	
Gasholders			24,891 13 4
Mains, Services, and Meters:			
142,120 yards of mains, from 2 in. to 24 in. diameter, the average area being 70 square inches, or 9½ in. diameter, at 12s. per yard, laid complete		85,272 0 0	
8515 services to private consumers, connected with new mains, including repairs of pavements, at 10s.		4,257 10 0	
2678 services to public lamps, connected, at 7s. 6d.		1,004 5 0	
8515 meters, for private consumers, at £2. 10s. each		21,287 10 0	
			111,821 5 0
			209,363 0 6
10 per cent. for contingencies			20,936 6 0
			230,299 6 6
Preliminary expenses		8,000 0 0	
Do. 1849		4,000 0 0	
			12,000 0 0
Floating capital			30,000 0 0
Total			£272,299 6 6

TABLE No. 2.

Dr. PRODUCTION ACCOUNT.	TOTAL COST OF PRODUCING: 368 Million Cubic Feet of Gas from 40,000 Tons of Coal.	1000 Cubic Feet of Gas, with a Consumption of 368 Million.
	£ s. d.	s. d.
To Coals, at 16s. per ton (producing 9200 feet per ton)	32,000 0 0	1 8·87
Labour, as per detailed estimate	7,455 1 6	0 4·86
Wear and tear of retorts	3,891 1 0	0 2·53
Lime, 817 yards £510 2 6		
Removal of refuse lime 204 5 0		
	714 7 6	0 ·46
Wear and tear of works and mains	3,066 13 4	0 2·
	47,127 3 4	2 6·72

Cr. PRODUCTION ACCOUNT.	TOTAL RESIDUAL PRODUCTS FROM: 368 Million Cubic Feet of Gas, made from 40,000 Tons of Coal.	1000 Cubic Feet of Gas, with a Consumption of 368 Million.
	£ s. d.	d.
By 26,667 chaldrons surplus coke (after using 33⅓ per cent. for heating retorts) for sale, at 10s. per chaldron	13,333 10 0	8·69
3200 chaldrons of breeze (8 chaldrons for 100 tons of coals) for sale, at 3s. per chaldron	480 0 0	·31
400,000 gals. of tar (being 10 gallons per 1 ton of coals used) for sale, at 1d. per gallon	1,666 13 4	1·08
	...	0 10·08
	15,480 3 4	—
The cost of production will be	£ 31,647 0 0	1 8·64

Brought forward—Cost of production				£31,647	0	0	1 8·61
Dr. DISTRIBUTION ACCOUNT.	TOTAL COST OF DISTRIBUTION FOR 368 Million Cubic Feet of Gas, made from 40,000 Tons of Coal.		1000 Cubic Feet of Gas, with a Consumption of 368 Million.				
	£	s.	d.				
To lighting and repairing of lamps, 2687, at 18s.	2,410	4	0	1·59			
Collection and bad debts (3 per cent. on rental)	1,840	0	0	1·20			
Rates and taxes (6s. in the pound on the assessment of £13,000)	3,900	0	0	2·54			
Law expenses	500	0	0	·32			
Stationery and incidental expenses	1,200	0	0	·78			
Directors	2,000	0	0	1·30			
Engineers, secretary, clerks, and inspectors	3,000	0	0	1·95			
Maintenance of works (1 per cent. on capital)	2,733	0	0	1·77			
Wear and tear of meters (15 per cent. on their value)	3,192	0	0	2·08			
...				...	20,765	4	0	1 1·51
The cost of production and distribution will be...£					53,412	4	0	2 10·15
Cr.							
By sale of 368,000,000 feet of gas,							
Less 61,333,333 for leakage, taken at one-sixth the quantity manufactured,							
306,666,667 feet, at 4s. per 1000 feet					61,333	4	0	
Difference on surplus profit, equal to 3½ per cent. on capital of £273,000					8,921	0	0	

	£	s.	d.
To pay a dividend of 10 per cent. on capital of £273,000 will require	27,300	0	0
From which deducting the difference or surplus profit as before	8,921	0	0
	18,379	0	0

There is a deficiency equal to 1s. 5½d. per 1000 feet on the 255,470,667 feet of gas estimated to be sold to private consumers, or an increase of from 4s. to 5s. 5½d. per 1000 cubic feet, which price the new company must charge to pay 10 per cent. dividend, and fulfil the other conditions of the scheme.

THE HISTORY OF THE GAS METER.

(*Continued from page* 117.)

Looking at the gas meter as it came from the hands of Malam, there are few men, however well versed they might be in the laws of fluids, who could discover any defect in it sufficient to prevent its introduction for general use. Yet experience soon pointed out to Mr. S. Crosley, into whose possession the patent right fell, that further improvement was still necessary; and to that task he consequently applied himself.

His labours, although by no means so important nor so replete with ingenuity as the efforts of those who preceded him, must not be undervalued; for it will be borne in mind that the difficulty of improving a machine increases in proportion to the degree of perfection it has arrived at; and the difficulties in this instance must have been considerable, after the minds of Clegg and Malam had been exhausted on the subject; for, while they lighted the path, they left nothing but the gleanings of the invention to their successors.

To render Crosley's improvement plain to the reader, it is necessary to premise that coal gas, from economical considerations, is delivered into the street mains at as low a pressure as possible. This pressure at the works does not exceed, in many cases, the force necessary to raise a column of water 1 inch high, while at the entrance to the premises of the consumer it frequently does not exceed the force due to a column of water half an inch high. If, therefore, a meter be placed in such a position to register the gas passed, it becomes essential that as little pressure as possible be deducted from the gas during its passage through it, and also that the friction of the meter wheel be at all parts of its revolution nearly equal, to ensure a sufficient and equable supply at all times to the burners.

However superior in these respects Malam's meter was to Clegg's, it was defective in both when compared with that introduced by Crosley—the reason of which will be evident upon referring to figs. 4 and 5 (page 116), and contrasting them with figs. 6, 7, 8, 9, which are now to be described. The former wheel, during its rotation, screws through its chambers *equal volumes of gas and water; and hence, for every cubic foot of gas delivered by it, one cubic foot of water must pass from the centre chamber through one or other of the measuring chambers into the outer casing, and from thence back again into the centre chamber by the centre openings.* The friction attendant upon this, added to the friction of the axis, amounted to about $\frac{3}{10}$ of an inch in a wheel of 9 inches in diameter, passing $\frac{1}{4}$ of a cubic foot of gas per minute, and the difference of friction at various parts of the wheel's rotation amounted to $\frac{3}{20}$ of an inch.

Crosley's wheel, on the contrary (fig. 5), is so formed that, while the gas is screwed through the chambers, the water passes directly from one chamber to the other; and the result is that in a wheel of the same dimensions as the former, and moving at the same speed, $\frac{3}{20}$ only is deducted, while the oscillation is barely appreciable by a water-gauge.

The partitions of the chambers also are placed at such an angle as is favourable to its passage through the water; and the Governor which was applied to Clegg's meter was in this dispensed with. The reflection is here irresistibly forced upon us, of the advantage which has arisen from the original defects of the meter, for to that is probably due the invention, by Clegg, of that simple and useful instrument.

This construction involved the necessity of placing the outlet slits, *w, x, y, z*, and inlet slits, *a, b, c, d*, at either end of the wheel, instead of in the exterior and interior rim, and also the removal of the receiving-chamber to one end, where it is formed by a convex cover, *k* (fig. 9), enclosing all the inlets into one chamber. This wheel is still indentical in principle with Malam's, and is, indeed, very like the first wheel which Malam contrived, but afterwards abandoned. I have called it Crosley's for the sake of distinction, although the merit of the invention of *that form* is only partially due to him. (See a drawing in Peckstone's "Treatise on Gas Lighting," 1819.)

The alteration effected by Crosley, though it possessed the two advantages above named, brought with it a defect of a serious kind, and one that has caused great annoyance and dissatisfaction both to gas companies and the public: that is, *the increased effect which the abstraction or filling in of water has upon the registration.* Many plans have since been resorted to for the purpose of confining this error within narrow limits, some of which will be noticed in their proper place. One or two manufacturers have even tried to introduce Malam's original form, but without success, as was the case with the "Equitable meter," brought out by Mr. Cowan, of Glasgow. Indeed, no permanent alteration has been made on the meter wheel since Crosley's time, with the exception of that made by Mr. A. Wright, a sketch of which is given at fig. 7. This improvement consists in cutting off from the outlet and inlet hoods of the wheel a piece of superfluous metal, which has the effect of still further decreasing the friction, by which means the smaller sized wheels are now made of greater diameter and less depth, without any additional friction or oscillation being produced. This form of wheel reduces the error in the registration produced by varying water-levels about one-fourth.

The great feature of the meter, the measuring-wheel, having now been traced from its origin to its present most perfect state, and the general principle of its mode of action having been explained, it will be well to show by a description of a somewhat more minute and scientific kind its exact principles of action, the mode of ascertaining the capacity of its chambers, the effect which the different heights of water have upon its registration, and how far the speed at which it moves, and the consequently increased friction affect, its measurement. These points may seem at first sight to concern the manufacturer more than the general reader; but I believe it will be acknowledged by those who have given any attention to this subject that of all hydraulic machines, the meter is the most perfect, and involves the most complicated laws of that science in its action; so that the study and comprehension of it will tend to open the mind to a better understanding of gas machinery, so much of which depends on hydraulic laws.

The meter wheel, as at present constructed, is a four-threaded

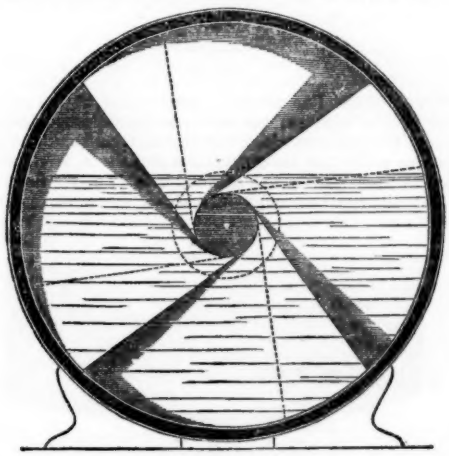

Fig. 6.—CROSLEY'S WHEEL.

Archimedean screw, each thread or spiral being greatly enlarged towards the middle, and spanning over an arc of nearly half

an inch, the exact shape of which is shown in figs. 8 and 9. Four such chambers as these will consequently form, when fitted together, an entire wheel, upon one end of which is put the raised cover, *k* (fig. 9), forming the receiving-chamber; Malam's form of wheel was also a four-threaded screw, but of the kind shown at fig. 4, page 116, the principal difference being that Malam's spirals may be said to be cut upon a cylinder of metal, while Crosley's are cut upon a cylinder of water. Malam's chambers have each two water seals, while Crosley's have one in the centre in addition, making three seals to each chamber. There are consequently twelve water-seals in the wheel, besides one in the centre of the receiving-chamber.

Fig. 7 is a front view of the present most-improved 3-light meter-

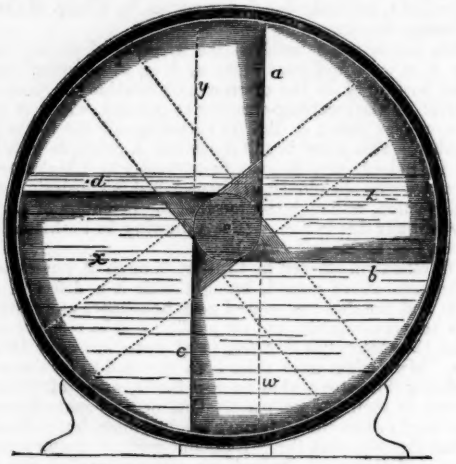

Fig. 7.—WRIGHT'S WHEEL.

wheel, drawn to ¼ scale, the convex cover being removed, so that the inlet slits, *a*, *b*, *c*, and *d*, are exposed. The dotted lines, marked *w*, *x*, *y*, *z*, mark the outlet slits on the other end of the wheel, while the smaller dotted lines show the position of the slanting division plates which separate the four chambers from each other.

Fig. 8 is a front view of one chamber, *a* being the inlet and *w*

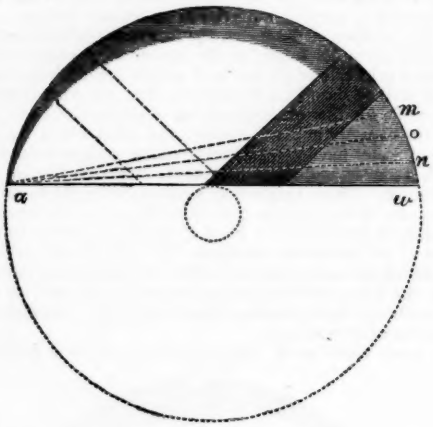

Fig. 8.

the outlet; *n* is the line marked by the water at the moment the chamber is filled with gas, the water being supposed at the lowest level, or at that point at which the float falls and shuts off the gas; *o* is the line which the water describes at the true level, and *m* is a similar line when ¼ of an inch of water is filled above the true level.

Fig. 9 is the appearance which a wheel has when looking down

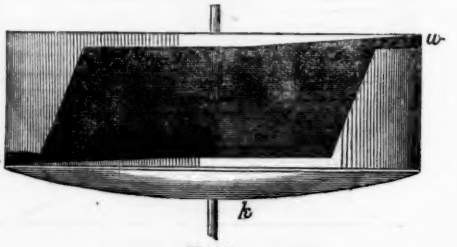

Fig. 9.

upon it, if all that part of the outer rim which covers one chamber be removed, *a* being the inlet and *w* the outlet.

Fig. 10 is the shape of the surface of the water in the chamber when at the line *m*, fig. 8.

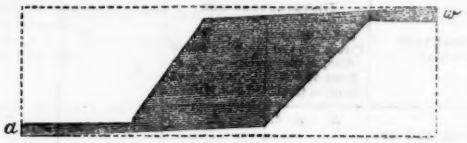

Fig. 10.

Fig 11 is the shape of the surface of the water in the chamber when at the line *n*.

Fig. 11.

Fig. 12 shows in section that part of the chamber which is affected by the difference of the levels of water.

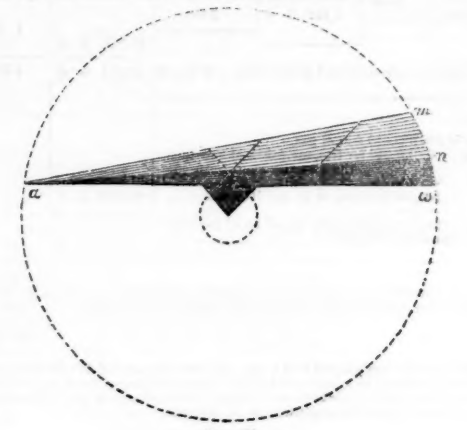

Fig. 12.

The action of this meter is so similar to Malam's, described in page 116, that it might be deemed superfluous to enter on it, were it not to develop more minutely one or two phenomena which render the recapitulation indispensable.

If the meter wheel be supposed to be in the position, figs. 7, 13, and the gas be admitted into the front box, fig. 13, it will pass through the L pipe, as shown by the arrows, into the receiving-chamber; from thence it will pass into the inlet hood, *a*, and pressing between the water and the partition of the chamber, acting like an expanding wedge to depress the one and raise the other. The water is the first to give way; when that is depressed about $\frac{1}{16}$ of an inch, the friction of the wheel is overcome, and the chamber acted upon rises out of the water, which immediately flows into the chamber to the left by the centre openings. When the inlet, *a*, has dipped into the water, it is clear that no more gas can enter the chamber to which it leads, and, consequently, the gaseous contents of the chamber at that moment, bounded as it is on five sides by metal plates, and on one side by water, gives the quantity which it can deliver to the burner. If the water be filled in ¼ of an inch higher—then would the inlet dip, while ½ an inch more of the outlet was still immersed in water, and consequently the chamber would be diminished in capacity by so much as is shown between the lines *o* and *m*, fig. 8; or if ¼ of an inch of water be taken out, then the inlet would dip, while ¼ an inch less of the outlet of the chamber was immersed, thereby increasing the capacity of the chamber so much as is shown between the lines *o* and *m*, fig. 8. Supposing, therefore, the lowest water line at which it is possible to pass gas through a meter of this size be to the highest as ½ an inch, then the variation will be shown by a figure the top of which is represented fig. 10, and the under side fig. 11, and the section of which is shown between the lines *n* and *m*, figs. 8 and 12; the most appropriate technical term to which would be a wedge-shaped trepezium.

We will now return to the action of the meter, which was left at the dipping of the inlet, *a*, in the water. When that has taken place the outlet *w* will be about 1 inch below the water, and during the progress of the wheel to raise this above the level, the gas in the chamber *a* is passive, the motive power of the wheel being meanwhile kept up by the pressure of the gas in chamber *b*, which, besides moving the wheel, transmits its surplus pressure to the gas flowing out of *w*.

Excessive pressure has *no* effect in depressing the water in the filling chamber of a meter, and thereby increasing its capacity, unless the speed of the wheel, or any other matter, cause excessive

friction; for the whole of the power or pressure given at the inlet is transmitted to the outlet, except that due to the friction of the wheel. Friction, however, produces the same effect on the chamber as abstraction of water, and gives the consumer some advantage. Increasing the speed of a meter beyond its proper limit, as it involves friction; also tends slightly to increase the capacity of the chambers. So little did the meter agitators know of this, in 1842, that they asserted that this was one of the means the gas companies used of cheating consumers, and pretended to give experiments to prove it.

It would occupy too much space to demonstrate the size of the wheel geometrically; the chambers being given to scale, it will form good exercise for those who have a turn for figures. Each chamber at the line *o* contains 54 cubic inches. The effect of reducing the level $\frac{1}{4}$ of an inch, as shown, will be to add about 2·1 cubic inches to the capacity of each chamber, and of increasing the level $\frac{1}{4}$ of an inch, to diminish the capacity $2\frac{1}{2}$ cubic inches. This error is about one-fourth less than in the deep 3-light wheel, as made by Crosley; and, as this object is obtained without limiting the range of the water-level, or interfering with the proper seal of the chambers, it is a step in the proper course.

We have now to speak of the means of limiting the water so that it shall not exceed a certain level, whereby the consumers may be materially injured by excessive registration, nor the companies defrauded by the abstraction or evaporation of water, which of late years has occupied much attention.

When the meter was first introduced, two protections of this kind were added to it: the one to cut the L pipe so low that any considerable excess of water should flow over and stop the supply; the other a float, with a valve attached to it, which was only supported so long as sufficient water was present to properly seal all the chambers, and prevent gas passing through the centre opening without moving the wheel, and consequently without registering.

Figs. 13 and 14 show some improvement on both of these points.

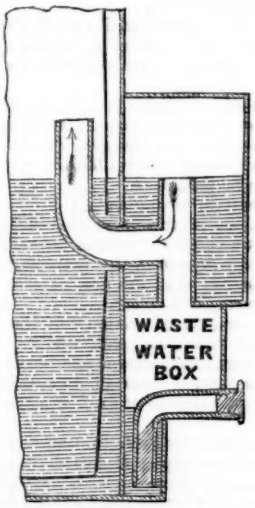

Fig. 13.

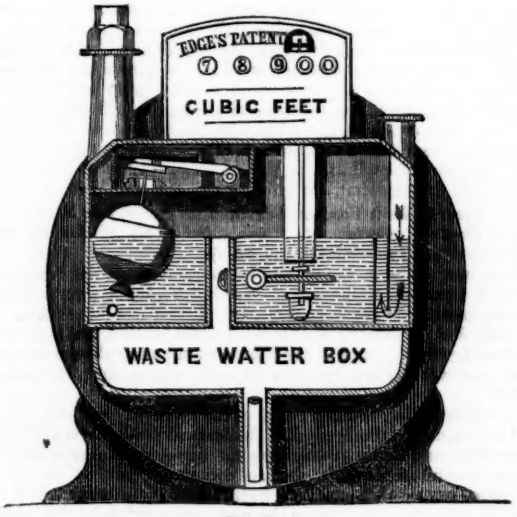

Fig. 14.

The L pipe, it will be seen, is cut to the water level, and connected with a distinct chamber large enough to receive any excess of water, while the float and valve act upon a hinge not so likely to become corroded as the guide-wires formerly used: the former of these is, we believe, the invention of Mr. F. Evans, and the latter of Mr. Wright, but are now the property of, and manufactured by, Mr. Edge. The merits of these and several other modern inventions must be left to the discrimination of the reader, for reasons given in a former part of this paper. The index also of this meter is of a peculiar kind, but the description of that will be left to a later period.

Several attempts have been made to introduce a reservoir on the principle of a bird fountain, to supply any deficiency of water which might accrue from evaporation. The first of these was by the Edinburgh Oil Gas Company, and the last by Mr. Hemming. They have all failed, and for this reason—that, when a portion of water was removed from the fountain, the air which filled up its place, being liable to expansion by heat, sent down water when it was not required, and the remedy was, therefore, more troublesome than the defect it promised to cure.

Mr. Hemming also introduced a solution of salt into meters for the purpose of neutralizing the effects of frost, as salt water does not often freeze in this climate; to protect the metal from the action of the salt, and also from the impurities in gas, each part of the meter had a piece of zinc soldered to it upon a similar theory to that suggested by Sir H. Davy in regard to copper-bottomed ships. This proved not only a failure, but a serious inconvenience, for it would seem that the zinc had the effect of increasing galvanic action, and the metals at their point of contact oxidized rapidly, while an *insoluble* oxide of zinc was formed, which hindered the proper action of the meter.

Many other minor improvements might be mentioned, but more important matter calls for our attention.

The meter as it now stands has some defects and many beauties, to be commented upon. Its principal defect is variation in the registration, the most glaring kind of which has been displayed in this paper, *for it is in smaller sizes* that this is principally shown, and it was the practice of those who attacked it some years ago to choose 3-light meters of the deep shape to display this to their over-credulous audiences. This defect is, after all, more speculative than practical, for the assertion of water accumulating in meters is not true in more than one case in a thousand, and that must be injudiciously placed. With proper treatment, therefore, they are only subject to the slight enlargement of their chambers from evaporation, and this is by no means to a great amount, as they are now made.

The freezing of the water in meters is generally a matter of a hard winter and an exposed situation, which can be avoided by a less exposed position.

With these defects, the importance of which can be estimated by practical men, it is a mathematically correct instrument, little liable to disarrangment, and, from its seals being all hydraulic, easily repaired when out of order. It has been frequently assailed, and as often risen again in public favour; but it has always stood in the opinion of scientific men as a masterpiece of the ingenuity and mechanical skill of the age and nation that produced it.

(*To be continued.*) X. Z.

GAS LIGHTING IN ITALY.

It will appear incredible to an English reader that, in the year 1850, a well-constructed and economically-conducted coal-gas work—having the exclusive supply of a rich European capital, numbering more than 100,000 inhabitants, and enjoying thorough communication by water with our own coal fields—should have exhausted an ample capital, and be reduced to the necessity of discontinuing its operations. Had it been Rome, or Constantinople, or Athens, or some other venerated relic of departed greatness, the wonder would be less intense; but that FLORENCE THE FAIR—once the cradle of the reviving arts, and now the treasury of their most glorious triumphs, the goal towards which every lover of them bends his steps, and quits with a sigh—should present us with such a spectacle, almost surpasses belief; though, when the causes of this state of things are inquired into, the result might have been almost anticipated. Every traveller who has trodden its busy streets, and remarked the life and activity pervading them,—the number and rich appearance of her bazaars and shops, the splendid equipages of her nobility and visitors, the palatial castles of her nobles, and hotels unequalled by any other Italian city,—must have been favourably impressed with its capabilities for the exercise of our art. The pilgrims who yearly crowd her galleries—where

> " the goddess loves in stone, and fills
> The air around with beauty"—

and remain unconsciously

> " Chain'd to the chariot of triumphal art"—

can with reluctance tear themselves away from the hallowed city, so full of recollections of those glorious days when Dante and Boccaccio rescued literature from the night of ignorance; when Michael Angelo and Raffaelle gave an undying impulse to the arts; or when Galileo's genius brought within the grasp of human

comprehension, subjects which had been hitherto beyond its reach. Who that has gazed with delight on the gates of her "Baptistery," those "Gates of Paradise," as Michael Angelo was wont to call them,—or sate on Dante's stone, where the great poet viewed the beauties of the rising Campanile; or wandered in ecstasy through the gorgeous saloons of the *Pitti* Palace; or lingered in the galleries of the *Ufizii*, in contemplation of its imperishable monuments of genius; or trod with reverence Sante Croce's sacred pile, and mourned over the ashes of the departed great,—will not only forgive but join in the enthusiasm with which the writer recals to his recollection the wondrous treasures which render Florence the most interesting capital of Europe, and crown her as the Queen of Italian Cities?

What a contrast between her active and industrious population and the lethargy and bigotry of her sister Rome: the one fostered by the most enlightened and paternal Government in Europe, the other oppressed by the most venal and imbecile! Florence *is* at the present day what Rome *was* in palmy days—the one a living body, the other a lifeless skeleton. Wealth and luxury meet us in the first at every corner; theatres abound; and everything contributes, so far as external appearances go, to the success and prosperity of a gas work.

The olive gardens of the surrounding hills are, however, formidable competitors to the distant coal fields of Great Britain; and oil, at less than 2s. per gallon, is a ruthless opponent of Newcastle coal at 40s. per ton, combined with public lighting at 4s. per 1000 cubic feet. In the Hudsonian times of 1845, the public, however, scarcely thought it necessary to examine the conditions and character of any speculation brought before them, being content with pocketing the premium at which every project was sure to be brought out, when ushered into existence with any respectable decoys, and recklessly leaving their future dupes to lament over their credulity. Indeed we have heard something more than a rumour, that, so late as 1849, the not inconsiderable sum of £9320 was paid, or agreed to be paid, for some "*Imperial Italian*" moonshine, in the shape of a gas "*concession*," or the permission for its fortunate purchasers to sink a good round sum more in the Thames or the Tiber, or on their banks, at their discretion. The year 1850 presents us with the singular spectacle of both a railway and a gas work on the point of suspending their operations, the earnings not covering the daily current expenses, and both seeking relief from their respective Governments by augmented rates of charges.

The Florence Gas Company has drawn up a statement of their situation and prospects, from which it appears that in 1845 the *concession*, or exclusive privilege of lighting the city with gas for a term of years, was granted to a firm who at that period enjoyed considerable reputation, and who without difficulty succeeded in forming a company for carrying the *concession* into operation. With this company they contracted for the erection of the works for the sum of £26,000, and further engaged to lease them for a term of years on advantageous terms. The £26,000 were duly paid; but the shareholders soon found out that they had been deceived in the prospects of the undertaking, and after paying a few quarters' rent the lessors suspended all payment, and the company found themselves compelled not only to take the work into their own possession, but to pay the debts of the lessors. A further call of £3000 was then made, and paid up by the shareholders. This sum, which was presumed to be sufficient for putting the works into an efficient state of repair and as working capital, was absorbed in a year. In seeking for the cause of this loss it was easily seen that it arose from the low price of the public lighting ($\frac{212}{1000}$d. per light per hour) in a town where English coal costs from 40s. to 48s. per ton! In one year the loss on the public lighting amounted to £1200; and, unfortunately, the low price of oil rendered the profit of the private lighting far from being sufficient to compensate for this loss. There remained, therefore, but two courses to take: either to abandon the works, representing with capital and interest a sum of £33,000; or to obtain from the town an augmentation in the price of the public lights. The shareholders, in the hope of an equitable solution of the difficulties, adopted the latter course, and voted a new call of £3000 to make up the deficiency and to provide a working capital; but made it a condition that this sum should only be paid up after the signature of a new contract, by which the town granted such an augmentation in the price as rendered the carrying on of the works practicable, and would allow the company to wait for the development of the private lighting.

A negotiation has been opened, and has been carried on for upwards of a year. The Florentine municipality, after a minute examination of the situation of the undertaking, the books of the company, and the state of the works, acknowledged in principle the justice of the demand, and granted them an augmentation, which increased the public lighting to $\frac{315}{1000}$d. per light per hour. This price was, nevertheless, to be subject to a diminution in proportion to the development of the private lighting, so that the old price should be re-established when 2500 private lights are obtained, there being now 963.

Such conditions will, however, never render the undertaking a profitable one; but the rude experience of the past, and the gravity of the present crisis in their affairs, render the shareholders less ambitious for the future. This future, mediocre as it is, seems, however, to be insecure; for we perceive that the municipality seeks to impose conditions which no gas work has hitherto been called upon to submit to, and which we are satisfied it is impossible to fulfil. In the meantime the resources of the company are becoming exhausted, in fact, are now exhausted, and, as the directors state, "We require not only a favourable solution but a prompt one; tardy relief will only save the ruins."

The following report of a chamber chemist, named by the municipality to examine the question, will be read with some interest, as well as the reply which it has produced from the talented practical man to whom this report had been referred by the company.

Report from Professor Cozzi to the Mayor of Florence.

"Yesterday, the 1st of June (1849), I repeated, with the director of the gas works, the experiment having for its object the ascertaining of the density of the gas actually furnished by the gas works of our city, and which, as I informed your lordship and the other members of the commission, now appeared to me to be of excellent quality. The specific gravity we found to be ·501. According to this experiment, and in conformity with what has been already said on this subject, so important for the public service, I think that in the contract the point of departure should be a specific gravity of ·500; and that only under circumstances difficult to foresee,—such, for example, as the employment of a less bituminous coal, or *the use of new furnaces, in which the draught is violent, and of which the heat cannot be regulated according to circumstances, like those which have been some time in use*,—then I think the specific gravity may be fixed at a minimum of ·450. So that the conditions I should impose upon the company in the contract, for the purpose of ensuring to the city and to private consumers gas of good quality and a proper supply, should be as follows:—

"1st. Specific gravity from ·500 to ·450, stipulating that this diminution should not be occasioned by long charges or high heats, but solely by causes impossible to foresee, and independent of their will.

"2nd. The quantity of bicarburetted hydrogen contained in the gas should be 11 volumes in 100.

"3rd. The gas daily manufactured should absorb, to effect its complete combustion, 1·94 to 2·10 of its volume of oxygen.

"4th. There should result from this combustion from 1·06 to 1·20 of carbonic acid.

"5th. Chlorine should condense 11 per cent. of its volume.

"6th. Sugar of lead paper, moistened with distilled water, should not be changed by contact with the gas; or, if it experience any change, it should be scarcely perceptible, as only very slight trace of sulphuric acid can be permitted.

"7th. It should contain no ammonia.

"8th. The dimensions of the flame should be fixed. I think, however, that those we possess at present are sufficient; for I have had occasion to satisfy myself in the preceding nights, when the gas was of good quality, that the gas lanterns were more than sufficient to fulfil the required object.

"9th. Clauses 51 and 52 of section 6 of the existing contract should be rigorously enforced; and, further, the lamplighters should be bound to clean the lanterns and burners *every day*, and, when they shall have lighted them all, to examine them a second time, so that each burner shall be of a uniform size, and not divided into different jets.

"10th. The regulation of the Prefecture, and especially the articles 18 and 21, should be rigorously applied to all the private consumers.

"11th. A person appointed by your lordships should daily examine, with suitable apparatus, whether the gas intended for the night's consumption present the qualities determined by paragraphs 1, 2, 3, 4, 5, 6, and 7; and this person should render a reasoned report of the state of the lighting on the preceding evening."

Our readers, who have studied Dr. Fyfe's communications in ou Journal, will be aware of the absurdity of attempting to obtain a gas from Newcastle coal fulfilling the condition required by this report. In fact their acceptance would have placed the company in as bad a position as they now stand, as they could only be complied with by using some of the superior qualities of Scotch cannel, at a cost fully equal to the advantage to be derived from the increased prices obtained; and we are, therefore, not surprised to see such a proposal repudiated in the following report made to the company by the gentleman to whom it was submitted:—

Report from M. Emile Vautier, Chemical Engineer, late Student at the "Ecole Centrale" of Paris, and Pupil of M. Dumas, Member of the French Institute, &c. &c.

"You have done me the honour to transmit to me the report of Professor Cozzi, dated the 2nd of June last, and to ask my opinion upon it, so far as relates to your works. I reply to your request.

"And, first, I extract from the work of the learned professor the following articles relating to the composition and quality of the gas which you were called upon to take the engagement to manufacture.

[Here follow articles 1 to 7 of the preceding report.]

"I commence by declaring that the learned professor is perfectly right in thinking that a gas uniting all these conditions would be excellent; unfortunately a gas so composed may be called *a theoretical gas*; and I state as a fact, that if at the present day we analyzed with care (employing the most approved processes which

science has invented) the gas manufactured in each of the numerous works in operation in Europe,—choosing those which manufacture best, and whose gas fulfils the most delicate wants of the consumer, —*we shall not find a single one which fulfils exactly, simultaneously, and in all their rigour, the seven conditions above mentioned.*

"We shall doubtless find in one work a gas which will satisfy the first condition, and of which the specific gravity will range between ·450 and ·500; but it is more than probable that it will not fulfil the other six conditions—that is, that, instead of 11 per cent. of bicarburetted hydrogen, it may contain some hundredths more or less; that, instead of absorbing 1·94 to 2·10 of oxygen, it may absorb a little more or less; that chlorine will not exactly condense 11 per cent. of its volume; and that, instead of containing no trace of ammonia, it may contain some hundredths.

"So, also, we shall easily find in one work a gas which will contain exactly 11 per cent. of bicarburetted hydrogen; but this same gas—will it have a specific gravity of ·450 to ·500? will it aborb 1·94 to 2·10 of oxygen? will it be condensed exactly 11 per cent. by chlorine, neither more nor less? will it contain no trace of ammonia? It is more than permitted to doubt it.

"We may also find a gas which will fulfil the third condition; but, then, will it satisfy, more or less, the first, second, fourth, sixth, and seventh? So that the difficulty or, rather, the impossibility of fulfilling the formula required by the report results not only from the obligation to produce a gas every day which shall conform exactly to the required conditions, but, above all, to obtain a product which, in a regular and constant manner, shall *simultaneously* satisfy all the prescriptions of the report.

"This impossibility would exist even with a gas produced in small experimental apparatus. In truth, there is not a chemist who would take the engagement to manufacture in his laboratory with the same apparatus, and from coal extracted from the same mine, a gas which should be exactly the same two days following each other, in two successive experiments.

"The impossibility of obtaining, in these conditions, a gas always perfectly identical, arises here from the nature even of the coal which produces it. Every one knows that the quality of coal not only varies in different mines, but that in the same mine it varies in different pits, and in the same pit between the different beds, and much more in the same heap of coal, according as the experiment is made upon coal as it rises from the mine, or after this same heap has been exposed some time to the air.

"I might here make an easy parade of erudition relative to the numerous experiments which have been made upon the composition of gas extracted from coal, particularly by the English chemists—Thomson, Christison, Turner, Fyfe, &c. &c. I will content myself by extracting the following results from an important work of Dr. A. Fyfe, Professor of Chemistry at King's College University, Aberdeen, upon the gases from coal, and the different varieties of the mines of England and Scotland—a work inserted in the 'Transactions of Royal Scottish Society of Arts' for 1842:—

> "'1st. *English Coal.*—The condensation by chlorine has varied from 3·5 per cent. to 5·5 per cent.; the mean of eight trials has been about 5 per cent.; the mean specific gravity of these eight trials has been ·464—the highest ·512, and the lowest ·414.
>
> "'2nd. *Wigan Cannel Coal.*—Chlorine indicates 7·5; the specific gravity from ·460 to ·520.'

"I will content myself with these two examples, which I could multiply. The conclusion to be drawn from them is simple and striking. Here are two gases extracted from different coals, and in both the condensation by chlorine *is less* than that prescribed in article 5 of the report, while in both the specific gravity satisfies, and even *surpasses*, the obligations of article 1 of the same report. Suppose, therefore, that you had taken the engagement asked of you, and that your coal-merchant had shipped you Wigan cannel coal—which is certainly a good coal—the gas which you would manufacture would be condensed less than 11 per cent. by chlorine, but would have a specific gravity exceeding ·500; *it would be, therefore, condemned by article 5 of the report, and permitted by article 1!* What will be, what can be, then, the judgment pronounced by the city of Florence?

"The impossibility of fulfilling all the conditions of the report result, then, in my opinion, from the obligation to fulfil them all at the same time, exactly and constantly. This simultaneousness it is perfectly impossible to obtain even in a chemical laboratory.

"But, if we quit the laboratory of the chemist and enter into the works of the manufacturer, how much the impossible becomes more impossible, if I may so express myself! It is no longer in small experimental apparatus, but in vast furnaces and large cast-iron retorts, where the distillation of coal is effected; it is no longer a question of making a few cubic feet of gas for experimental purposes, but to manufacture thousands of feet for each night's consumption. There is, therefore, an immeasurable distance separating theory from practice, pure science from its industrial application; it appears to me quite superfluous to dwell upon a distinction so evident.

"To sum up all, it is demonstrated that it impossible for a gas work to fulfil in its integrity the programme indicated in the before-mentioned report. This impossibility results not from each of the conditions in itself, *but from the obligation to fulfil them all at the same time, with an accuracy fixed by positive figures, regularly, and each day.*

"Such is my opinion, which I could have developed by analyzing each of the seven conditions which are proposed to you; but it seems to me that the question is sufficiently elucidated. No manufacture would be possible if the consumer required that the products were *chemically pure:* even the diamond is not so. The city of Florence has, no doubt, the right to impose upon you, manufacturers, the conditions of *manufacturing purity.* These conditions for gas lighting are—to have a specific gravity of from ·400 to ·500; to burn with a white flame, regularly, free from smoke, sparks, and sulphureous smell; to contain little or no sulphuric acid, and, consequently, only slightly to discolour acetate of lead paper, and also but slight traces of ammonia. A gas fulfilling these conditions, all of which may be satisfied at the same time, will be a product of manufacturing purity suitable, without exception, not only to the most exacting public lighting, but to the wants of the most difficult and the most delicate private lighting."

Whether the Florentine authorities will yield to the clear and lucid arguments of the above report remains yet to be seen; but the whole case is an instructive one, and shows the necessity of extreme caution on the part of shareholders before committing themselves to any similar undertakings in such a country. It is needless to say that the shares of the Florence company are now without value, a fate which, with few exceptions, attends almost every gas company of the Italian peninsula. Its thrifty and frugal inhabitants have ascertained by experiment that the light afforded by their native oil is less expensive than coal gas at remunerating prices; and, hence, we find that the Florence Gas Works, which at one time possessed 1200 private lights, is now diminished to 963, and reduced to a situation unexampled in the annals of gas lighting.

INAUGURAL LECTURE,

READ BY MR. CLEGG, JUN., BEFORE THE COLLEGE OF CIVIL ENGINEERS, SEPT. 26.

(*Concluded from page* 120.)

I have said that both architects and engineers must possess a knowledge of the strength and nature of the materials with which they have to work. This, I think, is self-evident, for the money to be expended is always one great element in their calculations; and the quantity of materials that can be usefully employed can only be ascertained by calculations based upon an intimate knowledge of the strains and forces they will have to resist, and the capabilities of the timber, the stone, the iron, or other substance that may be employed to resist them. Both Tredgold and Barlow have furnished us with admirable works from which the theoretical knowledge of the properties of all the materials used in building can be learned. There is no excuse, therefore, for failures of work arising from actual want of strength; but failures do sometimes occur, notwithstanding every precaution may have been taken to give to the materials, both theoretically and practically, their proper size and form, and proper distribution in the work. In engineering especially, circumstances are occurring every day, features constantly present themselves, of which even the oldest practitioner may have had no example previously; and other means taken to obviate evils that may and do thus arise may be the best that both science and art could point out, and yet fail in their object. I say that these are misfortunes only, not faults; but when they occur with a man unqualified with scientific knowledge to deal with them, they are very serious faults indeed, and should be visited with the utmost censure. Engineering is, of all professions (says Mr. Hyde Clarke), the military excepted, that in which in a new adaptation of expedients to unforeseen occurrences is ever most imperatively required, and in which a mere knowledge of past efforts will be insufficient, unless the mind be competent to invent new processes, as well as to avail itself of the best manner of old ones. No man can go upon a spot and say I will do such and such things at such expense; some unexpected variation of nature beneath the surface will often thwart the best-calculated plans, and render all attempts at economy abortive. It is practice, aided by scientific knowledge of the highest kind, that only can properly preside over the just application of materials to the ever-occurring variations which spring up in the course of an engineering undertaking. And, if science and practice sometimes fail in effecting their object at once, what must be the result when ignorance attempts the work? Failure, certain and disastrous failure, heaping disgrace upon the head of the quack practitioner, and often ruin upon his employers. I use the word advisedly; for, although neither architects nor engineers unfortunately need diplomas of practice to give them a right to the use of C.A. or C.E. after their names, they yet have morally, and in common honesty, an obligation which should bind them to certain spheres of work which they feel themselves qualified to undertake; and every man knows his own capabilities, depend upon it.

If, then, men calling themselves engineers or architects undertake a work they know they are incapable of performing without the assistance of a dry nurse, in the shape of a good "clerk of the works," they are quacks in every sense of the word, quacks as much as the charlatan who practises medicine without the consent of the colleges.

The demand for engineers caused by the late wild railway speculations has filled the profession with unqualified persons, and has tended to lower it below its proper level; and although the present times are, I am rejoiced to say, weeding them out pretty fast, it will, and must, be some time before it reaches its healthy state again.

It is true the Institution of Civil Engineers and the Institute of Architects exist, and men to become members of either must present proper qualifications; but there are numerous practitioners who are

not members, and who seek and gain employment. But I hope to see, ere long, by legislative enactment, both architect and engineer obliged to take out a diploma before being allowed to take upon themselves the responsibility of any work, when lives, or a sum of money beyond a certain amount, are at stake,—a diploma granted only after a severe examination as to scientific acquirements, and a practice under others of at least seven years.

I here beg permission to quote some passages from a paper written by Sir John Soane, which appeared in the "Artist" of June 13, 1807—as quotations from this high authority will give strength to what I have ventured to suggest myself:—

"An artist (architect), strictly so considered, is not sufficiently employed; his profession is too open to the assumption of persons who have no claim by education or ability; and these are admitted to that patronage without which the architect has no chance either of emolument or fame. There are, therefore, very few persons engaged solely in the practice of architecture. The great mass of those whom we here call architects, though many of them respectable in talents as artists, are under the necessity of combining with their study of the science pursuits not strictly analogous, and are, in consequence, and to their great discouragement and mortification, assimilated with another description of professional men called surveyors, and that name is again assumed by sorts and classes of building workmen and others, until it becomes utterly contemptible."

After enlarging somewhat (and in language by no means mild) upon the difficulties which beset an architect when carrying out a design, through the interference of public boards, and complaining, justly, that unqualified persons are allowed to enter into competition with him, by the aid of pilfered plans, Sir John concludes thus:—

"Before the state of architecture can be improved, and the professors excited to that species of emulation which only can make them eminent, strong and marked distinctions must take place. Those who have patronage must consider it a sacred trust and deposit,—the meed only of science and genius. The claims of the untaught, ignorant, and presumptuous must not only be disallowed, but repelled with indignation and contempt, till at length they are consigned to that obscurity whence they ought never to have been suffered to emerge."

Both engineer and architect must also be men of business; and to the knowledge of the uses and relative advantages of materials must be added the knowledge of their commercial value. The sum to be expended in any undertaking is always a marked feature; and the reputation of an engineer, especially, will be raised by the commercial success of his work. Harbours, roads, canals, and railways, before they are commenced, must show that the traffic or dues from them will amount to such a sum as will ensure to their projectors a proper return for their money. The first estimate of the engineer is the document from which the probable amount of returns is calculated. The statistical calculations, or the quantity of trade that will arise, are not, strictly speaking, in the department of the engineer, and he is not answerable if the scheme is not a paying one, from a deficiency in the traffic returns or dues; but, if it fail through any excessive expenditure over and above his estimate, he is answerable.

His estimate and schedule of prices, fixed through knowledge of local charges and custom of labour—through his close observation and acquaintance with the geological nature of the spot, and through his knowledge of the best districts from whence to draw his foreign materials—must be so worked out in detail, and capable of being referred to precedent, if precedent exist, or borne out by the opinion of others, that it will bear the investigation of a parliamentary committee; for be it remembered that estimates are the most vulnerable points in which opponents can strike you in the "House"; and, if the said estimates do not carry on the face of them the handiwork of a man of business, they will be the first and last work of the scheme, for the session in which they are brought forward at all events.

Perfect knowledge of the business habits of contractors, and of the working habits of artisans, can alone enable him to draw out his specification properly. It is true the lawyer will be called upon to give to it its legal phrases and finely-drawn pains and penalties of any breach in the performance thereof; but the lawyer will have to work upon a base of the engineer's planning, and, be sure, the blame will rest on him if any oversight has been committed on his part.

In the specification must be described the exact method by which the various works enumerated therein are to be performed. All the drawings must be enumerated, and more particularly referred to and explained: in short, the specification must be a book of reference, as it were, for the contractor, by which he can settle dimensions, quantities, and appeal to, in case of any dispute with his employers, as to the proper performance of his duty. There can, therefore, I think, be no doubt but that the engineer must be a thorough man of business.

Because I have not alluded in these examples to the architect, it must not be supposed that such documents as estimates and specifications are foreign to his practice; for equally with the engineer must he be capable of directing the *modus operandi* of his undertaking; nay, even probably with still greater minuteness of detail, seeing that his work is generally more minute, and depending more particularly on exact dimensions for its success.

Both architects and engineers must also understand those branches of law which relate to their profession, and study the science of jurisprudence, so far as to enable them to judge of the legality of their proceedings, to prevent their employers from being involved in lawsuits through their means, and to extricate them by the shortest way when so involved, by a cessation or alteration of the offensive operations, if the cause be connected with their pursuits. I mean not their duties should in any way trench on those of the attorney, or that they should advise in any matter involving a legal or technical question, for "a little law is a dangerous thing;" but they should always understand the particular sections of the law relating to their operations, that they may be able to steer clear of the dangerous rock of litigation.

All the laws of England contain enactments and regulations concerning building, and they consist both of written laws or statutes, and unwritten laws, or laws of common customs. It would be out of place here to describe all the laws which affect the operations of an engineer or architect, but I may be pardoned for making mention of one or two points that have come within my experience to serve as illustrations of my statement, that they should know "their own law."

For instance, when the inhabitants of a county are liable for the repairs of a public bridge, they are liable also to repair, to the extent of 100 yards, the highway at each end of the bridge. One instance came under my observation in which a surveyor neglected not only to take into account the existence of that law in his estimate of the work to be done, but even through his ignorance suffered an action to be brought against himself as the representative of the county. He lost the action, and the magistrates refused to bear him harmless, "because he ought to have known the law."

I may mention another instance in the case of a bridge. An engineer was employed by a private gentleman to build a bridge for a public road upon his estate: two years after its completion it was washed away by a flood. It had become so useful to the public that it was necessary to have it rebuilt, and the owner then thought that it might be erected at the expense of the county. But the county refused, because his engineer had not submitted his plans to, and obtained the approval of, the county surveyor.

An architect designed and erected for a gentleman a very expensive conservatory, and it was made portable, for, as this gentleman was only a yearly tenant, he intended to remove it should he change his residence. But his architect erected the conservatory on a brick foundation: it thus became a fixture, and the property of the landlord.

Examples of such cases might be repeated until the relation of them might fill a considerable volume, but those mentioned will serve to show that the artist employed to execute any works should inquire concerning the laws relating to them.

I have now said as much as the limits of a lecture will allow, upon the duties required of architects and engineers, and I will say a few words upon the duties of the general community with regard to architecture more especially.

If we refer to history we shall find that, exactly in proportion as civilization advanced, architecture flourished, had its rise, its progress, and decay. It took its styles, its varieties, and its tones from the nations who invented or introduced it; and what may be called, with great propriety, a national style, always existed.

Greece, during her independence, invented that architecture which, even at the present day, is our model. Her princes and rulers esteemed it the highest honour to be ranked with artists, and her buildings were looked upon by all as types of her glory.

Republican Rome, although she borrowed her designs from Greece, and built by the hands of Grecian artists, cherished architecture, because, through it, the Eternal City might be embellished, and the dignity of its citizens be enlarged; and although this did not, perhaps, arise from pure love and veneration of the art, it had its effects, and buildings were produced that have been handed down to us as forms worthy to be imitated to the present day.

The architecture of England also had its rise, progress, and decay. Its rise during the Anglo-Normans; its progress during the reigns of the Plantagenets and Tudors, when it arrived at the greatest excellence; and its decline may date from James I. (if we may include the Elizabethan, which, although not indigenous, has become, and perhaps deservedly, a favourite style in England), almost up to our own times; I say almost, for latterly, under the fostering patronage of royalty and men of taste and genius, it has struggled into a new existence: let us hope that it is the dawn of a new era for architecture and the fine arts in England. That this germ may bud and grow into healthy beauty, it will require the steady co-operation of all Englishmen connected in any way with architecture. Genuine professors of the art will gladly give their best energies to the task of regeneration, and we have already examples which tell in glorious language (language engraven in stone) what will be the result of those energies. Nothing is wanted but men of influence and taste to add weight to the balance already inclining so decidedly in favour of purity and fitness of style.

I am an advocate for fitness in the style of architecture of every building, civil, military, or ecclesiastic; and would those through whose patronage the fine arts flourish study, equally with its professors, the true meaning and intent of fitness, there would speedily be an end to incongruity, and English buildings would stand prominently out as types of English architecture.

Both Grecian and Palladian architecture have taken so firm a root in the soil of England, that any attempt to dismiss the styles at once would be useless, and perhaps fatal to the regeneration of a national one. But will not a little consideration show that these styles are unfitted for the English climate throughout the year? The windows, few and far between, obstruct the light. The low pitched-roofs retain the snow and rain, and the projecting porticoes throw shadows where there is already too much shade. An Italian villa, appropriately situate, may fitly serve as a summer residence, but we must seek in another style that comfort and homeness so loved by all Englishmen; for this style we need not become imitators or pilferers from a foreign nation.

The high-pitched roof, the ornamented gable, the oriel window, the irregular plan, suitable as well for internal convenience as for external beauty, are all characteristics of our English style, and each feature has, besides, fitness to our climate to further recommend it. I wish particularly to be understood that I now speak of domestic architecture,—for that of public edifices we may still be indebted to Greece or Rome.

Our palaces, institutions, and prisons may still be in the decorated Corinthian, the chaste Palladian, or the stern and sombre Doric. But

let our residences, our *country* residences, serve to keep us in mind of our former genius, while they add to our comfort and enjoyment.

One word more before we leave this subject, upon a point which every man has power to forward. I allude to internal decoration. In this branch of art the house-painter, the paper-hanger, and the joiner are too often allowed to usurp the place of artists, and suffered to bedaub the walls with incongruous colours or tasteless wood-work. Joiners, in particular, have a kind of systematized patent to work evil things; custom to one set of forms and method of work has so fixed itself upon us that the same set of moulding-planes, the same kind of panelling, serves for all styles of houses. The architect himself is probably somewhat to blame in this, but I believe only to a small extent, for builders, not architects, are generally employed to run up the brick and stucco boxes called houses, and these, building either per contract or for themselves, to save money and trouble, are little inclined to study propriety in internal finish. It is not that the architect considers it to be beneath him to be the decorator; for Raffaelle painted the walls of the Vatican, Rubens's hand embellished the ceiling of Whitehall, Sir James Thornhill decorated the walls of the Chapel and Hall of Greenwich, and we have Owen Jones in our day.

It cannot, therefore, be through any false notion of the architect that these internal finishings are left to artisans; but, whether it be or not, every gentleman, every man of cultivated mind, is to blame who suffers his house to be coloured up to suit the taste of the sign-painter, who, without any feeling of art in his composition, daubs away in any shade of any pigment he may fancy to be in fashion.

Many patrons of the arts would fire up and say indignantly, "I do not suffer this outrage upon taste to be committed in my house." And I am only happy to admit that there are some glorious exceptions to my rule; but that they are exceptions I will uphold, and say confidently that eight out of ten have houses painted, fitted, and furnished with designs that have issued from the shop, and not from the studio.

Poor men in the present state of things cannot, perhaps, help this; and the poor man with refined feelings for art must submit, for he cannot alter.

But rich men are those to whom I point, and say, Study art, and be judges yourselves where art is employed, or consult those whose whole life has been devoted to the cultivation of it, and who will work for you, not for money alone, but for the love of art: architects should be such men.

[After an outline of the system of instruction he intended to follow, the lecturer continued.]

It is likewise my wish to make all the students familiar with the use of tools, and that they should become practical as well as scientific workmen; that this is essential I have the high authority of the late Mr. Telford, who has said, "Youths of respectability and competent education, who contemplate civil engineering as a profession, are seldom aware how far they ought to descend in order to found the basis of future elevation. It has happened to me more than once, when taking opportunities of being useful to a young man of merit, that I have experienced opposition in taking him from his books and drawings, and placing a mallet and chisel or a trowel in his hands, till, rendered confident by the solid knowledge which only experience can bestow, he was qualified to insist on the due performance of workmanship, and to judge of merit as well in the lower as in the higher departments of a profession in which no kind or degree of practical knowledge is superfluous.

Correspondence.

ON GAS PRICES.

Sir,—The letter of "A Gas Proprietor," published under this head in your valuable Journal of the present month, is a fair specimen of the feelings and arguments (if so they can be called) of the members of his class. Permit one, therefore, who belongs to the great body of gas consumers, to make a few remarks in reply to the extraordinary position which the frightened gentleman assumes; and I trust to your impartiality for giving them a place in your next number.

His chief argument is, that because the shares of the companies he names are at present much below their par value, and that two of them have of late years been without dividends, the price of gas had reached its lowest point; and that, consequently, all agitation of the question of a further reduction is unjust to those who have invested money in these speculations.

But, sir, I think I shall have little difficulty in convincing even "A Gas Proprietor," that such an argument is untenable, and does injury to the cause he espouses; for, if carried a little further, it amounts to this monstrous doctrine, that any body of individuals who inconsiderately squander their capital, or ignorantly conduct their trade, acquire by these circumstances a claim on the public gratitude and consideration. It is notorious to all the world that the past history of one of the companies he names, entitles it rather to be held up as a warning to others who would imprudently extend their operations, than to be cited as a proof that the present price of gas is unremunerating.

If, however, instead of attempting to blind the public by relying upon the market value of the shares as evidence of the price of gas having reached its minimum, "A Gas Proprietor" had given us the last year's balance-sheets of each of the three companies he alludes to, we should have seen more clearly how two of them came to be without any dividends; how much had in truth been expended in new works and apparatus, or to pay off old scores, to say nothing of debentures, bonded debts, and preference shares, and, perhaps, in the reimbursement of some borrowed capital. I happen, unfortunately, to be a holder of some South Devon Railway shares, and, therefore, have had a lesson as to how capital may be raised, and the entire earnings of a good concern swamped, by the usurious conditions which bonded creditors may be able to impose; indeed, I have some recollection that one of these gas companies was lately in the market seeking to place an amount of six per cent. preference shares, representing a large portion of its capital. The value of the unguaranteed shares must of course be very equivocal: £10 for the £50 share is a high price under such circumstances; and, if any one will take my South Devons at the same rate, I shall consider myself to have got well out of the scrape.

The Chartered I believe to be an honestly-conducted and well-managed concern—without debts or encumbrances, and possessed of a property which amply represents the value of their share capital. The whole earnings are, therefore, divisible among the shareholders, who, it would seem, receive six per cent., which, according to my notion, is a very insufficient rate of interest for capital invested in such a perishable property, and one which will assuredly not tempt me into buying shares in any gas company. If six per cent. is *all* that is earned, £40 is the utmost value of the shares, which would then yield only 7½ per cent. interest to the holder. And here I may be permitted to remark that shareholders generally ruin their own property in running prices of shares up to large premiums, and thus bring competitors into the market. Gas shares are, in my opinion, like uncertain terminable annuities, and every owner should make a reserve to pay back his capital. Consols at 90 are better investment in the long run than are gas shares (paying six per cent.) at 20 per cent. discount; and so many purchasers at heavy premiums will find out, sooner or later. These remarks, perhaps, may not have much value, as I must confess that I have had but little experience in such matters. I think, however, I have demolished the argument of the "Gas Proprietor" as to the market value of the shares having anything to do with the question he writes upon; but I will tell him a few truths, unknown perhaps to him and his class, which have had far more to do with raising the storm he maladroitly attempts to calm, than any envy of the gains which the gas companies are believed to have amassed; and, if my warning voice can penetrate into the board-rooms and councils of the great interests he represents, I think I shall have rendered more service to his cause than he has done himself.

The supply of gas must, from its very nature, be a monopoly; and all monopolies, if not conducted on just and liberal principles, become odious, and outrage public feeling. A call for competition thence arises, which may for a time be successful, and the monopolists be humbled. Shareholders, however, cannot long be contented with the glory of having fought and vanquished their opponents: they clamour for something more substantial, in the shape of dividends upon their capital. A gas work is not like a steam-boat or a stage-coach, which, if unprofitably employed on one station, can seek occupation on another; but the property of a gas work is sunk in the soil where first located, and there it must remain, to prosper or be ruined, according as the various occupants can annihilate or make terms with each other. Hence is created a second monopoly, more odious and grinding than the first, because a larger sum has to be wrung from the pockets of its helpless victims, and so on, *ad infinitum*, each step augmenting the evil. The districts mentioned by the "Gas Proprietor" have been twice visited in this manner; and I rather suspect that the practice complained of by a correspondent in your Journal for September must be one of the consequences of this state of things. Such a practice is nothing less than legalized robbery, and cannot be too strongly reprobated.

Monopolies in gas we must, therefore, have. But monopolies have their *duties* as well as rights. If I am compelled to submit to them, I have a right to see that I am supplied with a good article in sufficient quantity, at a fair price, and am not fettered by conditions repugnant to justice, equity, and common sense; and it is their duty to grant these. A monopoly based upon such principles I willingly accept; but apply opposite ones, and it becomes odious; and here, in my opinion, lies the great secret of the clamour of the present day. The iron hand has been too visible; the velvet glove with which Napoleon was wont to conceal his despotic acts has been abandoned, and might has taken the place of right.

Price has, I believe, had little to do in creating the present agitation; for my part, I am quite satisfied in that respect; and I believe that your Journal has done much towards disabusing the public mind of many of its preconceived notions as to the cost of gas. The successive and rapid reductions from 12s. to 10s., 9s., 8s., 7s., and 6s., led me and others to conceive that gas cost nothing, and that the companies only sacrificed a portion of their profits in making these successive reductions; but now I see we are approaching the point where further reductions will be more gradual, and can only be effected as the consumption is increased to the full extent of the powers of supply now possessed by the existing companies. No one begrudges them their six per cent. dividend, and I should be much better pleased to hear that any well-conducted concern, like the Chartered, yielded 7½ per cent. than seek to diminish the paltry profit now earned at the present prices. The grievance does not, in my opinion, lay here, but rather in the constitution of the administrative bodies themselves, and the overbearing tyranny of some of their members.

Take my own case as an example. Some time since I believed I had reason to complain of the bad quality and insufficient quantity of the gas supplied to me; and, wishing at once to go to the fountain-head, I applied at the head office for an interview with the secretary of the company. The porter in attendance took in my name, and, after detaining me some time, came back to request me to state the object of my visit. I did so, and received a crusty message to the effect that the complaint must be made to the inspector, and not to the secretary. I had previously mentioned my dissatisfaction to the collector, who gave me to understand that I was not the only complainant, but that his duty was only to collect my money, and not to get himself into trouble with the people at the works. I am perfectly ignorant who the inspector is. I have burnt gas by meter for three years, and beyond a quarterly visit from a workman, whose duty it is take the register of the meter index, I know no one but the collector. In truth, instead of Mr. Hawksley's practice of adjusting the water line of a meter eight times a year being followed, I declare upon my honour that mine has not been touched by the company's agents for three years, except to take the index. If, therefore, it registers against the company (as "A Gas Proprietor" asserts meters in general do) the fault is not mine, but is due to the lax management of the company. Before commencing to burn by meter, I examined their construction, and satisfied myself of their capability of accurately measuring the gas; and there, so far as I am concerned, my inquiries ceased. Can any one wonder, then, that the shares of a company so conducted are at fifty per cent. discount? My only surprise is that they have retained so many of their customers, if my experience of their mode of transacting business is confirmed by others, which I have every reason to believe is the fact.

Take, again, the cases quoted by the "London Gas-fitter," in your September Journal (and I know of many similar ones). For every such instance of the arbitrary abuse of their powers you will find a hundred mouths ready to advocate the cause of the first agitator who promises to correct such abuses; and, for every pound so saved or gained, thousands are ultimately sacrificed. Public companies cannot be governed by a different code of morality to private individuals. The same line of fair dealing and justice which I practise behind my counter, and thereby gain a connection, must be practised by gas companies if they wish to increase the number of their clients and enjoy their confidence. These are conditions which are often lost sight of by public companies. At one period, during the competition between the three your correspondent mentions, the greatest laxity prevailed, to which the public became quickly habituated; and now, when some of the abuses of such a state of things have ceased, the imposition of conditions repugnant to justice, equity, and common sense, are rendered doubly odious by the previous abandonment of all correct economical principles for the sake of injuring or crushing a rival. I say fearlessly that had a gas company, when without a rival in its field, borne in mind *that monopoly has its duties as well as its rights*, a state so discordant to sound commercial principles as three capitals being engaged where one might have sufficed would never have existed. Look at the little Independent Gas Company, which has for twenty-five years conducted its operations on the true principles of the trade. In every reduction it has led the way voluntarily and without compulsion. Its customers have now confidence in it, and feel assured that, whenever a further reduction is possible, they will not even have to ask for it. Hence that calm security which gives value to all property, and has maintained the £40 share of this company at £60 and upwards during the present crisis. I hope the "Gas Proprietor" has a few of these good ones among his gas shares, though it would have destroyed his case to have told us so.

It appears to me that in the large metropolitan gas companies the responsibility is too much divided; that, in fact, they are *over-directed*, and that practically an irresponsible management is the result. Directors cannot profitably occupy themselves with the petty details of a gas work; these should be left to responsible agents enjoying and meriting the general confidence. Under the present system, the *actual* managers seem to be powerless; the real management being assumed by directors whose time is more often employed in looking after the day-labourers, than in acquainting themselves with the wants and wishes of their customers, and in enlarging their circle. If they had been oftener selected from my class, we should not have witnessed that gross ignorance of public feeling which some bodies have recently manifested.

Strand, Nov. 29. A Gas Consumer.

HISTORY OF THE GAS METER.

Sir,—I hope your Journal will meet with the patronage of gas companies it so deservedly merits. To practical managers, who have never made gas lighting a scientific study, it is an invaluable miscellany; and it opens up to the scientific student a means of submitting his researches to the scrutiny of his philosophic brethren. It furnishes, also, a link of communication between gas companies throughout the United Kingdom; and, as "union is strength," it is well calculated to protect their interests from the knave, the fool, and the reckless speculator. It supplies the opportunity of stripping sophistry of its disguise, pedantry of its philosophic trappings, and cupidity of its distortions. In fact, it embraces the interests of the public, as well as those of gas companies; and any unnatural pressure imposed upon the latter must react on the former in the direct ratio of its intensity. It is said that the public is a selfish animal, and has no real regard to anything but its own *interests*, and sacrifices to that Moloch alike bad, good, and indifferent, in the plenitude of its irrational caprices. Be it so; let it be clearly shown that its highest interests are involved in rejecting sinister speculators by past practical illustrations—of which there are abundant on record—and puff-shares will remain unsold, ay, and ungiven too, in quiet possession of the patriotic impostors, spite of their El-Dorado promises and philosophic bombast, from the very legitimate employment of this most influential motive. So much for my humble opinion of your invaluable Journal in its relations to the literature and pecuniary interests of the country.

The true cause, however, which draws me from obscurity, and inspires me to break through my natural timidity, is an error into which you have inadvertently fallen, either conjecturally or by means of a mistaken correspondent; and it is one—according to your own showing, as will be shown in the sequel also—in which my future fame is deeply implicated; and it is better, as Byron says,

> "At the gen'ral call
> Be damn'd, than noticed not at all."

You have certainly striven manfully to immortalize the name of "Malam" in the last number of your excellent Journal. Of course no blame attaches itself to you should the claimant for the wreath of fame be compelled to surrender it to its legitimate owner. To you, sir, we are indebted for its characteristic identity, as well as to its station in the archives of science. Whoever invented the "bent pipe" is "second to none in modern times"! This is a splendid eulogium! Did *I* ever imagine that the Journal of Gas Lighting was destined to furnish *me* with the means of competing for companionship with a Watt? Well, whoever deprecates the Journal of Gas Lighting, I shall strain every nerve to its utmost tension to sustain it, for it will be the life or death of my posthumous immortality. Probably I shall never have such another chance—if indeed you, sir, condescend to honour me with this; nor should I have known this, "but have been born to blush unseen," but for your excellent Journal. Long live the Journal of Gas Lighting!

Now, sir, had Mr. George Palmer claimed this invention, I had for ever remained dumb; but I do not feel disposed to surrender it to Malam. Mr. P. will remember my suggesting this said "bent pipe" to him, after a night spent in thought, to complete his Archimedean blowing-machine—a period anterior to Mr. Malam's thought of either meter or meter improvement. This is where Mr. Malam borrowed it from; and, if old Joseph Hutcheson was alive, he would set the matter at rest beyond the possibility of contradiction, and place me at the head of modern inventors. I heard a good deal, and said a good deal too, at the identical period that these said "transactions" took place in the "Society of Arts." *Ars est celere artem.*

Clegg struck out the path for improvers, and planted around himself a mass of parasites; these hide the parent trunk out of sight in the luxuriance of their foliage, and the multitude are solicited, through an ignorant or corrupt press, to admire *these* instead of the original. Well, there is this consolation, it has always been so. As it was, is now, and ever shall be. I cannot for the life of me, sir, nor do I believe you would add, Amen! To claim as your own another man's invention is dishonesty, and to reprobate every such claimant is the imperative duty of every honest journalist.

You will pardon me, sir, if I strive to cut one of these leafy gentlemen to make room for the parent stock to bloom. It is said the agave blossoms only once in fifty years; perhaps this is the reason why my fame has been so long coming to maturity; and this is the reason, too, why the blossom is now so gorgeous.

To you, sir, we are deeply indebted for calling public attention to the beauteous invention, and also to the inventor.

For my own simple part I thought the thing itself unworthy of a puff, more especially as a "wonderful invention"; but I shall never forget with what eclat it was hailed at the time by certain parties. A blowing-machine—a steam-engine was to be patented. I laughed in my sleeve at the mechanical harlequinade, and asked my friend Hutcheson "Where's the fulcrum for the lever, Joseph?" "That's a Syracusan after-thought," drily said he. After a deal of floundering about, the blowing-machine and steam-engine died of the dropsy, and were buried in the blast furnace—bent pipe and all—without the ceremony of a funeral oration, except, indeed, a long loud growl over the cost. Up jumps the pipe, phœnix-like, from the fire, and the next place in which it was destined to figure, lo and behold! was in the gas meter; and, after having rested in that position many years unfathered, Mr. Malam is brought forward as its putative parent. But I object to this. Its true father is still living; and you, Mr. Editor, have raised him to the proud pre-eminence of an evergreen—*fama semper viret*. I claim, sir, to be the inventor of the bent pipe—or I am *an* inventor of the bent pipe—and claim precedence of Mr. Malam. To Mr Malam is due the praise of adapting it to the improvement of the meter, but this is all. The question, however, is not its adaptation but its inven-

tion. I am its inventor, and the sketch furnished was one of my first attempts to gain power by this hydraulic machine before Mr. Malam came to Westminster.

Gas Works, Dartford, Nov. 13. WM. GREEN.

[We willingly insert the letter of our facetious correspondent, though we must plead *not guilty* to any intentional neglect of his claim to the invention of the bent inlet pipe of the gas meter, which we now for the first time bring before the public. We wish him many years' enjoyment of his honours].

ON THE COST PRICE OF GAS.

SIR,—Your correspondent "R. W. I." deserves credit for having broken through the natural reserve which generally encircles the managers of gas works, and invited public criticism of his well or ill doing. If others could be induced to follow his excellent example, and confide in your discretion for the use you may make of their communications, much good would result, as I have no doubt will be the case to your correspondent "R. W. I." in the present instance.

I have the management of a small gas work of about the same extent, but have not kept my accounts exactly, on the formulæ in which he has done, although I shall do so for the future. Our total make of gas is very nearly the same; but I have a less number of public lights (which I light all the year round), and have a large private consumption, my price for the latter being 8s. per 1000 feet. My rental returns me 6s. 3d. for each 1000 feet of gas made. I use the small coals of our county, which cost 10s. per ton delivered, and sell the coke at from 15s. to 16s. 8d. per ton. I formerly used large kidney-shaped iron retorts, but of late have adopted cylindrical clay ones, 15 inches diameter and 8 feet long, which have as yet given me great satisfaction, and materially diminished the expenses of carrying on the works. I have ten such retorts, viz., a bench of five, one of three, and another of two retorts; and, if I had room, I should like to set another bench of threes, which would render my works perfect.

The following remarks have suggested themselves to my mind in examining "R. W. I.'s" return:—

Whence arise the great variations in the yield of gas from the coals? I see they range from 358 to 461 feet per cwt.; mine only vary from 440 to 475, except on lighting up a new bed, when for a few days the retorts leak considerably. But I see in the month of December, with a consumption of 57 tons 16 cwt. of coal, "R. W. I.'s" yield was only at the rate of 7160 feet per ton.

The winter fuel account is high; but I suppose this may arise from a deficiency in the means of storing gas, a larger number of retorts requiring to be heated than could be necesssary were the gasholders of sufficient capacity. I can do with five of my retorts as much work as eight and ten of your correspondent's. He further makes a capital error in charging the fuel at 5d. per bushel, and crediting the coke account at 5½d. for all the coke made. If the latter price can be obtained, then the fuel should be charged at the same rate; and this will increase the total cost of the fuel £18. 16s. 5d.

It is evident that the purifiers have been charged by *time*, and not by *test*, as the quantity of lime used has been the same, whether the quantity of gas made has been 65,000 or 390,000 feet. The gas must have been horridly impure in the latter case, and the lime scarcely soiled in the former. With me the *average* is 6000 feet to each bushel of unslaked lime. In summer, when I am making but little gas, and it traverses the purifiers at a slow speed, I can reach 9000 feet; but in winter I get a soiled test when 5000 is exceeded.

The charge for wages includes items which should properly go to wear and tear, viz.: retort setting, laying mains, &c. My workmen are—one stoker at 18s. per week, one at 16s., and a lamplighter at 14s. Wages with us may possibly be lower than with your correspondent.

I would send you a tabular statement of my working; but, as it may be more intelligible to adhere to that already before your readers, I have, in the enclosed, adapted my workings to your correspondent's cost of materials and quantity of gas made: taking his figures for wages, salaries, interest, rent and taxes, but diminishing by one-half his allowance for wear and tear of retorts, which will amply cover my expenditure in that department with clay retorts.

The total cost, according to your correspondent's system is £972 19 3

To which add his error in the fuel account .. 18 16 5

991 15 8

And on my system 909 2 7

Being a saving of .. .. £ 82 13 1

In conclusion, I can only say I should be happy to have the charge of such a gas work at the liberal salary which appears to be given, or to contract for the manufacture of the gas at the rate of 6s. 4d. per 1000 feet, including coals, lime, labour, wear and tear, and my own remuneration for superintendence, instead of 6s. 10½d., the present cost.

———, *Somersetshire, Nov.* 24. H. C.

1	2	3		4	5			6		7	8	9	10	11	12			13	14	15	16	17	18	19	20	21
Date. 1848. Months in action.	No. of Retorts in action.	Coals used in Retorts.		Gas made in M. Cubic Feet.	Coke used for Fuel.			Lime used for Purifiers.		Wages. Stokers, Lighters, Auxiliary Labour for Laying Mains, Retort Setting, &c.	Wear and Tear at per M. Feet; say 3d.	Salaries, at 1s. per M. Feet.	Interest...1 9 Taxes and Rent ...1 3 Per M. Ft. 3 0	Total Gross Monthly Cost of Gas.	Coke Produced, reckoning 37½ bushels to the ton, or 1⅔ bushels to the cwt.			Net Monthly Cost of Gas.	Gas made per Cwt. of Coal.	Gas Purified per Bushel of Lime.	Cost of Coals per M. Feet of Gas.	Cost of Fuel per M. Feet of Gas.	Cost of Lime per M. Feet of Gas.	Cost of Wages per M. Feet of Gas.	Total Net Cost of Gas per M. Feet.	Coke Sold.
		Cwt.	Cost. £ s. d.		Bushels.	Cost. £ s. d.	Total Cost. £ s. d.	Bushels.	Cost. £ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Bushels.	Price sold, 5½d.	Total Value at Selling Price. £ s. d.	£ s. d.			s. d.	d.	d.	s. d.	s. d.	Bushels.
Jan. -	5	866	32 9 6	390	760	5½	17 8 4	65	2 3 4	24 15 0	4 17 6	19 10 0	68 10 0	159 13 8	1623	5½	37 3 10½	122 9 9½	450	6000	0	7·8	1·33	1 3¼	6 3¼	863
Feb. -	5	585	21 18 9	270	696	,,	15 19 0	45	1 10 0	12 10 0	3 7 6	13 10 0	40 10 0	109 5 3	1098	,,	25 3 3	84 2 0	461	6000	0	11·3	1·33	0 11	6 2¼	402
March	5 to 3	550	20 12 6	239	732	,,	16 15 6	40	1 6 8	10 10 0	2 19 9	11 19 0	35 7 0	99 10 5	1031	,,	23 12 6½	75 17 10½	434	6975	1	1·7	1·34	0 10½	6 4	299
April -	3	505	18 18 9	227	564	,,	12 18 6	38	1 5 4	13 10 0	2 16 9	11 7 0	34 1 0	94 17 4	946	,,	21 13 7	73 3 9	449	6973	0	10·7	1·29	1 2¼	6 5¼	332
May -	3 to 2	283	10 12 3	123	476	,,	10 18 2	21	0 14 0	9 15 0	1 10 9	6 3 0	18 9 0	68 2 2	540	,,	12 7 6	45 14 8	434	5857	1	5·8	1·36	1 7	7 5¼	—
June -	2	144	5 8 0	65	384	,,	8 16 0	11	0 7 4	19 10 0	1 6 3	3 5 0	9 15 0	48 7 7	270	,,	6 3 9	42 3 10	461	5909	2	5·5	1·35	6 0	12 11¼	—
July -	2	198	7 8 6	89	396	,,	9 1 6	15	0 10 0	13 10 0	1 2 3	4 9 0	13 7 0	49 8 3	370	,,	8 9 7	40 18 8	449	5933	1	9·6	1·34	3 0	9 2¼	—
Aug. -	2	227	8 10 3	102	420	,,	9 12 6	17	0 11 4	13 10 2	1 5 6	5 2 0	15 6 0	63 17 9	426	,,	9 15 3	44 2 6	449	6000	1	7·7	1·33	2 8	8 7¾	—
Sept. -	2 to 3	418	15 13 6	190	498	,,	11 8 3	34	1 2 8	10 18 6	2 7 6	9 10 0	28 10 0	79 10 5	785	,,	17 19 9½	61 10 7½	454	5688	0	11·5	1·43	1 1¾	6 5¾	267
Oct. -	3	821	30 15 9	375	575	,,	13 3 6½	63	2 2 0	14 10 3	4 13 9	18 15 0	56 5 0	140 5 3¼	1538	,,	35 4 11	105 0 4¾	456	5952	0	5·5	1·34	0 9¼	5 7	963
Nov. -	3 to 5	817	30 12 9	360	710	,,	16 5 5	60	2 0 0	10 10 8	4 10 0	18 0 0	54 0 0	135 18 10	1532	,,	35 2 2	100 16 8	440	6000	0	7·8	1·33	0 7	5 7¼	822
Dec. -	5	956	35 17 0	410	784	,,	17 19 4	70	2 6 8	10 17 8	5 2 6	20 10 0	61 10 0	154 3 2	1792	,,	41 1 4	113 1 10	428	5857	0	7·4	1·36	0 6¼	5 6	1008
		6370	238 17 6	2840	6995	—	160 6 0½	479	15 19 4	164 7 3	35 10 0	142 0 0	425 10 0	1183 0 1½	11951	—	273 17 6½	909 2 7	446		1	0·8	1·35	1 2	6 4¼	4956

QUALITY OF GAS IN LONDON.

Sir,—In the late agitation upon the City gas question, much has been said about the inferior quality of the gas supplied by the old companies; but I have never seen it stated *what* the new company propose to give us, further than that it shall be better and purer,—terms too indefinite to be admitted into any such contract. This has led me to analyze the quality of that now supplied to me by the City of London Gas Company; and I would suggest to the Commissioners of Sewers that stringent clauses should be introduced into the new contract, by which the public will be secured that the quality shall not be inferior to the following:—

1st. Its specific gravity shall not be less than 0·400.

2nd. It shall be condensed 6·5 per cent. in bulk on being exposed to the action of chlorine.

3rd. It shall require for its complete combustion 1·3 times its volume of oxygen, and the product shall be 0·7 of carbonic acid.

4th. It shall contain no trace of sulphuretted hydrogen, ammonia, carbonic acid, or carbonic oxide.

5th. An argand burner, consuming 5 feet per hour, shall give a light equal to 14 sperm candles, $\frac{13}{16}$ of an inch diameter, 9 inches long, and consuming 120 grains per hour.

London, Dec. 12, 1849. An Amateur Chemist.

GREAT CENTRAL GAS CONSUMERS' COMPANY.

A Court of Common Council was held in the Council-chamber, Guildhall, at twelve o'clock, on Dec. 14, the Right Hon. the Lord Mayor in the chair.

Mr. Thomas Dakin rose to present a petition from the directors of the Great Central Gas Consumers' Company (some of whom appeared at the bar), for leave to contract with the corporation to supply the Mansion-house, Guildhall, and other public establishments under their control, with gas, upon the same terms as the contracts entered into with private consumers, for the purpose of enabling the company to ascertain the probable amount of their consumption, in order that they may adapt the extent of their works to the extent of their requirements.

Mr. H. L. Taylor said that, previous to Mr. Dakin making his motion, or complying with the prayer of the petition, he wished to ask the petitioners a question. Mr. Taylor then put several questions to the petitioners, which were answered by Mr. Wyld, M.P., who appeared as the organ of the company. The answers went to show that several members of the corporation were connected, as directors, and in other capacities, with the new gas company. He then proceeded: He had elicited sufficient from the petitioners to prove that they were not before the court, nor, indeed, could they be. Let the Town-clerk read the fortieth standing order. [This request was immediately complied with. The standing order prohibited any member of the court from contracting with the court, or any of its committees or commissions, to perform any work or to supply any materials which have to be paid for out of the City funds.] Mr. Taylor then continued: According to that standing order he held that a company partly composed of members of the corporation could not come before that court as petitioners, to ask to be allowed to supply the court with gas, until, at all events, that standing order was suspended,

Mr. Deputy Harrison maintained that the fortieth standing order did not apply to the shareholders of any public company established by charter. Members both of the old gas companies and of the New River Company were members of that court, and if the standing order applied to the new gas company it equally applied to those other companies. But what was the corporation to do for gas if this standing order precluded their dealing with chartered companies?

Mr. Sheriff Lawrance said it was not now the question whether a breach of the rule had been committed with respect to either companies. The question was—was it agreeable to the standing order for a company to which members of the corporation belonged, now to present this petition? Every distinct question must be dealt with separately, as it arose, on its own merits.

Mr. Dakin said, the meaning of the rule obviously was, that no member of the court, in his business or profession, could do work for or supply the corporation; but it could not be strained to apply to larger bodies incorporated by act of Parliament. This distinction was very clear.

After some discussion,

The Common Sergeant announced that the opinion of the Lord Mayor was, that the standing order applied to individuals but not to companies. But his lordship also thought that, whether or not it should apply to corporate bodies contracting was a matter for the court to determine.

It was then put to a show of hands, whether the standing order applied to the petition before the court, when the question was carried in the negative by a large majority.

Mr. Deputy Lott, Mr. Sheriff Lawrance, and Mr. Towse then proceeded, amidst much confusion, severally to interrogate the petitioners respecting the position of the company.

Mr. Wyld, as before, replied to each of the querists, and his answers were nearly as follows:—He presumed that a great many members of that court, as well as other most respectable citizens and gas-consumers, were shareholders in the company. £8275 was the amount paid up on the capital of £150,000. The shares were £10 each. Mr. Croll had 1250 shares. The company originated among the gas-consumers of the City. Could not say that it originated with the honourable member for Lambeth. They proposed erecting their works sufficiently extensive to supply 400 million cubic feet; and they had an agreement in writing to buy two pieces of ground at Bow-common for that purpose. They had received not only promises of permission from the intervening parishes to bring their pipes into the City, but promises of support also from the parishes. They would not delay the erection of their works till they obtained the permission of the parishes. They had the means of bringing their pipes into the City, without the consent of the parishes, because they had obtained the consent of certain railway companies to do so. They had received 4500 contracts to supply gas. One half of the contracts had been fresh signed since they lost their bill last session. The contracts stand good till 1850, and there was no necessity for having them resigned. Whether that court allowed them to light the Guildhall and the Mansion-house or not would not alter their original intention as to the extent of their work. Only two members of that court who had previously been connected with the company had discontinued their relation to the company. The original intention of the company was to supply the citizens of London only; but, if the old companies entered into undue competition with the new one, the new company would do their best to protect themselves. £1 was the amount paid up on each share. 5000 shares were yet to be taken by the contractors.

The examination having concluded, the petitioners were ordered to withdraw.

Mr. Dakin then rose to move—"That the prayer of the petition be complied with; and that it be an instruction to the several committees superintending the lighting of the various buildings and establishments connected with this corporation to give the needful directions therein." He said that he was pleased with the turn the subject had taken, as the petitioners earnestly desired that every publicity should be given to their proceedings and their position. They were not a body of private speculators seeking their own personal aggrandizement, but men who were solely actuated by public motives, regardless of every other consideration. What the petitioners wanted was, that that court should lend its sanction to a public object. And, speaking of a public object, what was its money value? It had saved £40,000 a year already to the citizens; and, when the further supply enabled them to reduce the price another shilling, they would save to the citizens another £20,000, making £60,000 a year altogether. And this sum, it should be remembered, was not to be saved by a ruinous competition, but by a fair, honourable, and remunerative mode of carrying on a business. But that was not the new company's only claim to countenance and support. A supply of cheap and good gaslight for the poor artisan living in the lanes and alleys of the City was a measure of sanitary as well as of moral improvement. Look at its effect in other places. In Dundee there were 12,000 gas consumers, and half the revenue of the company was made up of persons who paid under 20s. a year. It was used by the very humblest inhabitants, even by those occupying cellars. And in Edinburgh also one third of the rental of the gas companies was made up by consumers under 20s. a year. In fact, the smallest house would not let in these places if it was not fitted up with gas. And why should it not be the same in London? for he was sure it would be a great social benefit. But, then, that could only be effected by allowing a young and vigorous rival to enter into competition with a company that had grown hoary, and he had almost said decrepit, with age. After a few further remarks Mr. Dakin concluded by proposing his motion.

Mr. Norris seconded it.

Mr. Salomons, seconded by Mr. H. L. Taylor, moved the adjournment of the question, on the ground that the court was now so exhausted, that due consideration could not be given to it that day.

The adjournment was then put to a show of hands and lost.

Mr. Sheriff Lawrance then called for a division.

The court divided, when there appeared—For the adjournment, 19; against it, 38.

Mr. Alderman Salomons said, that, as the court had just decided to go on, he must state his objections to acceding to this petition. If they complied with that petition it would appear in the eyes of the world like jobbery and corruption in favour of their own members, who were shareholders in this company. Again, this company appeared to him to be founded on the confiscation of the property now employed in gas-making; and further, he considered the conditions which the Commissioners of Sewers were to enter into with the new company were illegal; and if another company started, offering cheaper gas, they would be precluded from entertaining its claims. He must, therefore, oppose the motion.

Sir P. Laurie must renew the motion for adjournment. (Oh, oh!)

Mr. H. L. Taylor said, he would divide the court twenty times, rather than the question should be settled that day. (Great confusion.)

On a division there appeared 18 for the adjournment and 25 against it. The discussion was again resumed, but the opponents of the motion manifesting an evident determination to divide the court *ad infinitum*, until they should exhaust the patience of the other side,

Mr. Sheriff Lawrance said, that, under ordinary circumstances, they did not see a factious opposition offered; but the present were not ordinary circumstances, for members of that corporation stood there to give a vote that would make them the recipients of the public money. (Name, name.) Name, indeed! their name was Legion. For his part, he would stay there and divide till midnight. (Confusion.) The new company never intended to open the street; all they wanted was as advantageous a compromise as possible.

Mr. Dakin repudiated such an insinuation on the part of the petitioners. They were determined to carry out their intentions towards the public.

M. H. L. Taylor did not believe it. (Renewed confusion.)

Mr. Towse here rose and proposed that the court, which had been gradually dwindling away in its numbers, should be counted.

On the announcement of this motion, one or two of the members standing near the bar made a rush to the door, and the number left being just insufficient to form a quorum, the court was at last abruptly brought to a close, after a sitting of nearly five hours.

On the evening of the 20th ult. an extraordinary general meeting of the proprietors and shareholders of the Great Central Gas Con-

sumers' Company took place at the London Tavern, when the chair was occupied by C. Pearson, Esq., M.P., the object of which meeting was for the purpose of considering the clauses of the proposed bill about to be introduced into Parliament by this company. Among the persons assembled we saw James Wyld, Esq., M.P.; Messrs. Massey, Dakin, Clemow, Gabriel, Bovill, and others of the directors of the new company; W. J. Hall, Esq., Thomas Hall, Esq., Messrs. W. A. Larby, Lowe, Tickling, Thomas Smith, and other large consumers.

The CHAIRMAN, in opening the proceedings of the evening, said that their meeting would necessarily be a short one, because within an hour they would be attended by deputations from the various wards of the City, who would come for the purpose of expressing the sentiments of their constituents on the subject which they had attended to promote. He was happy to see so many gentlemen present; but, as he believed that most business was done well when they had only a short time in which to perform it, he was not sorry that they were in that predicament. He held in his hand a report from the directors to the shareholders, in which they recommended that an act of Parliament should be obtained on the basis of the Model Gas Act, for which purpose they had directed their solicitors to prepare the draught of a bill, with a view to carry out the objects proposed in their prospectus, and to which draught the directors recommended the shareholders to give their concurrence, which was merely a formal act. It was well known that, during the last session of Parliament, they went to the House of Commons for this purpose, but, in consequence of some objections which had been taken as to the phraseology, the bill was withdrawn, which opposition had been created by the fact that the old companies had expended no less a sum than £150,000 in the building of their works within the city of London. They, however, had determined to build their works on a cheaper land, and they had succeeded in procuring six acres of land, well adapted for the purposes of this company, for only £4800 (hear, hear); while the price the rival companies had given was, at least, £20,000 per acre. (Hear, hear.) They, therefore, possessed an advantage which the rival companies could not boast, in the price given for the purchase of the land; but, in addition, the proximity of the land which they possessed to a railroad, afforded another considerable advantage, for they could have their coals put into their works for only 1s. per ton, every expense included; whereas the other companies were compelled to pay a considerably larger sum. Under these circumstances the directors felt that they presented themselves before the shareholders and the public in the most favourable aspect. The clauses of their proposed bill were principally founded upon the Model Gas Act, and was of great importance to the public, for it prevented the company from ever dividing more than 10 per cent. profit, and compelled them to apply the surplus in the reduction of the price of gas to the consumer; and, therefore, there was no doubt that, while the consumers would pay a low price, the shareholders would also receive but a very small dividend. (Hear, hear.) It had been thought best to adjust a reasonable price for the gas, with a reasonable profit to the shareholder. (Hear, hear.) The directors supposed that 10 per cent. profit was but reasonable: while 4s. per 1000 cubic feet was but a fair price for good gas, subject to a reduction in price when a larger consumption should yield a larger profit; and with that view the promoters of the bill had endeavoured fairly to adjust the relative interests of both consumer and shareholder. (Hear, hear.) The various clauses of their proposed bill had been explained to them from time to time, and it would, therefore, he presumed, be quite unnecessary to occupy their time by again formally reading them to the meeting. They contained the usual quantity of as's and whereas's, and all the other paraphernalia of legal documents (laughter), which had been prepared with great accuracy and precision, in which the interests of the shareholders had been completely protected, while, at the same time, the public would be sure of obtaining pure and good gas at a reasonable price. Having explained the object which they contemplated, perhaps some gentleman would move a resolution empowering the directors to go to Parliament with the bill which the solicitors had prepared. (Hear, hear.)

Mr. HALL, seconded by Mr. LOWE, moved that the directors be requested to go to Parliament with the bill which had been prepared by them.

Mr. FLINTOFF said that, before the resolution was put from the chair, he was desirous that the clauses of the proposed bill should be read to the meeting *in extenso;* and, if that were not done, he should think it his duty to propose that the bill be rejected altogether. (Hear, hear.) It had been asserted, because he did not quite agree with the movements of the new company, that he had been bribed by the old companies to enter his opposition to their proceedings; but this he fearlessly denied. Unless every gentleman were allowed an opportunity of expressing his honest convictions, they could never expect to succeed in any undertaking. The contract which the directors had made with Mr. Croll was a most ridiculous one—a point which the gentleman endeavoured to establish by reading from a paper which he held in his hand a long list of calculations, with the view of showing that Mr. Croll would make a profit of not less than from £5000 to £6000 per annum. He also thought that £2000 a year was much too large a sum to be paid to the directors of a new company. Amid loud cries of "Question," and the general impatience of his auditors, the gentleman at length sat down, without moving any amendment.

The CHAIRMAN said that before he put the resolution, which had been proposed and seconded, it was right to inform the meeting that the supposed salary of £2000 a year to be paid to the directors was altogether a fallacy; they had not received one farthing, nor would they. No provision could be made in this respect, except at a general meeting of the shareholders, who from time to time would fix the amount of remuneration to which they might think their services fairly entitled, and which would of course be regulated according to the estimate formed of their work by the shareholders. (Hear.) In regard to the contract made by Mr. Croll, he was prepared to prove that the interests of the shareholders had been best protected by that contract; for experience had decided that joint-stock companies made but bad manufacturers, and that they had better look to private enterprise and to the talent of an enterprising individual, bound down by heavy responsibilities and great securities, to manufacture the best article at the cheapest rate.

The resolution, empowering the directors to go to Parliament, with their prepared bill, was then put, and unanimously adopted.

The CHAIRMAN said it had been stated in one of the newspapers that that company was all moonshine; that the work could not be accomplished, and that the whole affair was a delusion; but he had the pleasure of informing the assembly that one of the first houses in the nation had come forward and made a tender to execute the whole of the works, and lay down the pipes, for a less sum than the amount of Mr. Croll's estimate (hear); while at the same time they were willing, if the directors agreed, to sweep the board of all unallotted shares, and take them in part payment of the contract. (Hear, hear.) It was, therefore, now a great fact, and a realized certainty, that on or before the 25th of June next they would have cheap and pure gas supplied by the new company to the houses of the citizens of London. Some objections had been started by their opponents to the formation of that company, on the ground that the Commissioners of Sewers had no power to allow them to put down their pipes; which objection the directors had set at rest by the opinion of the Attorney-General, and four other learned counsel, all of whom agreed that the Commissioners of Sewers had full power to allow them to put down their pipes in the city of London, if they thought proper to do so, and which permission they had granted.

On the motion of Mr. HALL, seconded by Mr. LOWE, the draught of the bill was then read and approved.

Mr. PEARSON then said that, the business of the shareholders being concluded, he should vacate the chair, for the purpose of introducing the ward committees and gas consumers to form a public meeting; which having been done, Mr. HALL was voted to the chair, who said that their proceedings would then be directed to the consideration of the best means to be adopted by the citizens for the procuring of cheap and good gas.

Mr. H. J. HALL then moved the first resolution, to the effect that the meeting should form themselves into a general committee, to adopt measures for procuring a cheap supply of good gas.

Mr. HARE seconded the resolution, stating that they had had bad gas long enough, and he was glad that there was now a prospect of getting brighter, purer, and cheaper gas.

This resolution was adopted unanimously.

Mr. PEARSON then rose and said, with much warmth of feeling, that he thought it right to inform the meeting that he had sent a letter to his brother directors, containing his resignation from the directorship of the company, on the ground that, as he was an officer of the corporation, he felt that he could no longer remain one of their directors. His brother directors had, however, requested him to hold office until their most important duty had been performed. He had determined to serve the public to the last hour of his life; and he would not, therefore, leave the company until they obtained the object which they sought—that of procuring good gas at a cheap price. (Hear.) He would also take care that the contract which had been entered into for their works should be built up in the most substantial manner. The solicitors on each side of him were men of skill and acuteness, and they were well qualified to protect the interests of the company. It would be quite unnecessary for him to explain the clauses of the bill, for they were plain and easy of interpretation. It was right for him to say that the directors had paid up all their shares in full, the whole calls upon 1500 shares having been paid up. In conclusion he would also state that no shares would now be disposable except to gas consumers, as the whole of them had been allotted. (Hear.) He, therefore, had no hesitation in saying that in less than eighteen months the company would be able to pay a dividend of £10 per cent.

Mr. FOX then proposed that the meeting do accept the clauses as proposed by the directors.

Mr. LARBY seconded the resolution, which was then unanimously adopted.

A gentleman, whose name we could not learn, here said that he was in business as a gas-fitter, and having seen it stated in a newspaper that it was the intention of the new company to supply all the gas fittings, by which they hoped to procure a profit for the shareholders which they could not obtain by the cheap gas, he was anxious to put that question to the chairman, and he, therefore, asked, once and for ever, whether there was any truth in such report?

Mr. PEARSON said he would immediately allay any alarm which the gentleman might have experienced by the report to which he had referred. He had the pleasure of stating that there was not one word of truth in the report alluded to; the company had no intention whatever of taking upon themselves the supply of gas fittings, and the bill which they had prepared distinctly forbade them from doing so. (Hear, hear.) They did not think that it would be at all fair for a great company to enter into competition with small tradesmen for the supply of an important article. (Hear, hear.) They did not desire to destroy one monopoly for the purpose of raising up another. (Hear.)

Mr. HALL regretted that Mr. Pearson intended to resign his position as a director of their company, as they were much indebted to him for many things; and, therefore, he would convey his respects to that gentleman for his great exertions, and hoped that every wardmote on St. Thomas's day would also express their approbation of the services he had rendered, and concluded by moving a resolution to that effect, hoping that Mr. Pearson would rescind his intention of retiring from the directorship.

The motion having been seconded, and passed unanimously, Mr. PEARSON returned thanks, the business concluded, and the meeting separated.

Share List.

THE PRICES QUOTED ARE THOSE AT WHICH THE LAST SALES HAVE BEEN MADE.

The Companies whose names are printed in italic type are incorporated by Act of Parliament.

Number of Shares issued.	Amount per Share	Name of Company.	Amount paid up per Share	Dividend per Cent. per Ann.	Price.
	£	**ENGLAND.**	£ s. d	£ s. d	£ s. d
		Aberdare			
		Abergavenny			
		Aberystwith			
		Abingdon			
		Accrington £5500		5 0 0	
		Alcester			
		Alford, Lincolnsh.			
		Alfreton			
		Alnwick			
		Alston Moor			
		Alton			
800	5	Altrincham	5 0 0		
		Amlwch			
		Ampthill			
350	10	Andover	10 0 0	6 0 0	11 0 0
		Appleby			
		Arundel			
		Ashbourn, Derby			
		Ashburton			
		Ashby-de-la-Zouch			
		Ashford, Kent			
		Ashton-under-Line £42,500		13 4 0	
		Atherstone			
		Axminster			
225	20	Aylesbury	20 0 0	5 0 0	20 0 0
		Aylsham, Norfolk			
		Bacup, Yorkshire			
		Bakewell			
		Baldock			
140	25	Banbury	25 0 0		
		Bangor			
500	5	Barking, Essex	4 10 0	5 11 0	5 0 0
250	10	Barnard Castle	10 0 0	5 10 0	10 15 0
		Barnet			
		Barnsley £6000		7 10 0	
100	20	Barnstaple	20 0 0	7 10 0	25 0 0
		Barton			
120	25	Basingstoke	25 0 0	8 0 0	28 0 0
2400	20	*Bath*	16 0 0	10 0 0	21 to 23
		Battle £2000		6 0 0	
56	26½	Bawtry	26 10 0	5 0 0	25 0 0
		Beccles, Bungay, and Lowestoft			
		Bedford			
		Belford			
		Bedale, Yorkshire			
		Belper			
		Beminster			
700	5½	Berwick-on-Tweed	5 10 0	6 8 0	5 15 0
		Beverley			
		Bewdley			
280	10	Bideford	10 0 0	6 0 0	10 10 0
		Biggleswade			
		Bicester			
		Bilston £25,000			
		Billericay			
		Bingley			
		Birkenhead and Claughton £56553	35 0 0	3 7 6	32 to 34
2400	50	*Birmingham and Staffordshire*	50 0 0	8 0 0	64 to 66
	25	*Ditto*, new shares	7 10 0	8 0 0	10½ to 11½
704	75	Birmingham	75 0 0	6 13 4	108 to 110
		Bishop's Auckland			
		Bishop's Stortford			
		Blackburn £24,000		8 0 0	
		Blandford			
		Blythe			
		Bodmin			
		Bolton £49,500		9 0 0	
		Boroughbridge			
		Boston £8000		6 0 0	
200	10	Bourn	10 0 0	5 0 0	
		Brackley			
		Bradford, Wilts			
		Bradford, Yorksh. £45,000		10 0 0	
		Brampton, Cumb.			
		Brandon, Suffolk			
		Brecon			
		Bridge-end, Glam.			
		Brierly Hill			
2250	20	*Brighton*	20 0 0	5 0 0	16 to 16 10
1125	20	„ new shares	16 0 0	5 0 0	
		Brighton and Hove £50,276			
4250	20	*Bristol*	20 0 0	10 0 0	37 to 39
1630	25	*Bristol and Clifton*	25 0 0	6 0 0	25 0 0
		Brixham			
		Braintree			
750	50	*Brentford*	50 0 0	6 0 0	46 to 48
800	25	„ new shares	11 0 0	6 0 0	11 0 0
		Brentwood			
		Bridgnorth			
		Bridgwater £6000		5 0 0	
400	10	Bridlington	10 0 0		8 0 0
		Bridport			
		Brigg			
		Broadstairs			
100	50	Bromley, Kent	50 0 0	6 0 0	52 10 0
		Bromsgrove			
120	10	Bruton	10 0 0	4 0 0	8 0 0
100	25	Buckingham	25 0 0	5 0 0	25 0 0
		Bungay (see Beccles)			
		Burford			
		Burlington			
		Burnley £19,946			
		Burslem			
		Burton-on-Trent			
		Bury St. Edmund's			
		Bury, Lancashire £6570			
		Buxton			
		Callington			
		Calne, Wilts			
		Camborne			
		Cambridge £32,000		7 0 0	
240	50	*Canterbury* Gas and Water	50 0 0	6 0 0	57 to 58
240	25	*Ditto*, second issue	25 0 0	6 0 0	25 0 0
		Cardiff £10,500		7 10 0	
		Carlisle £9000		8 0 0	
		Carmarthen			
		Carnarvon			
		Chapel on the Frith			
		Chard			
		Chatham (see Rochester)			
		Chatteris			
		Cheadle			
		Chelmsford			
		Cheltenham £17,242 10s.		8 10 0	
		Chepstow			
		Chertsey			
		Chesham, Bucks			
		Chester			
		Chesterfield £12,023 14s. 1d.			
240	25	Chichester	25 0 0	6 0 0	30 0 0
		Chippenham			
		Chipping Norton			
		Chorley			
		Cirencester			
		Clifton (Bristol and Clifton)			
		Cleckheaton, York.			
		Clitheroe			
		Cockermouth			
		Colchester			
		Colne, Lancashire			
		Coleford, Gloucest.			
		Coggeshall			
		Congleton £5000		7 10 0	
		Cowbridge			
800	25	*Coventry*	25 0 0	5 0 0	20 0 0
		Cowes			
		Crewkerne			
		Croydon			
		Cranbrook £1900		5 0 0	
		Crediton			
		Crewe, Cheshire			
		Darlaston			
		Darlington			
250	20	Dartford	20 0 0	7 10 0	27 0 0
		Dartmouth			
125	20	Daventry	20 0 0	6 0 0	24 8 0
		Dawley, Shrop.			
		Dawlish			
500	6	Denbigh	6 0 0	5 0 0	6 0 0
820	10	Deptford, Bermondsey, and Rotherhithe	10 0 0	5 0 0	4 10 0
		Derby £16,250		7 10 0	
90	20	Dereham (East)	20 0 0	4 10 0	
1000	5	*Dewsbury*	5 0 0	7 10 0	8 12 6
		Devizes			
4000	5	*Devonport*	5 0 0	6 0 0	5 14 0
		Diss			
		Doncaster			
280	25	Dorchester	25 0 0	5 0 0	25 0 0
120	25	Dorking	20 10 0	5 0 0	21 10 0
		Douglas, Isle of M.			
209	56½	*Dover*	56 10 0	6 0 0	56 10 0
		Downham			
		Driffield			
		Droitwich			
600	20	*Dudley*	20 0 0	4 0 0	14 to 16
		Dunmow			
		Dunstable			
		Durham			
276	9	Dursley, Gloster	9 0 0	5 10 0	8 0 0
		Elland			
		Ellesmere			
300	19	Epsom	19 0 0		
		Evesham			
		Exeter £40,000		8 0 0	
		Exmouth			
		Eye, Suffolk			
		Fakenham			
		Falmouth			
		Fareham			
120	25	Farnham	25 0 0	10 0 0	42 0 0
		Farringdon			
		Faversham			
		Fleetwood			
		Folkestone			
		Frome			
		Gillingham, Dorset			
		Glastonbury			
		Glossop £6000		7 0 0	
		Gloucester £24,600		7 10 0	
		Gomersal			
		Godalming			
		Gosport			
		Grantham			
		Gravesend			
1000	10	*Great Grimsby*	6 10 0	8 0 0	8 5 0
		Guildford			
		Guisborough			
		Hadleigh			
		Hales Owen			
300	6	Halesworth	6 0 0	7 10 0	5 10 0
		Halifax £15,000		8 0 0	
		Halstead			
		Harleston			
		Harrogate £10,000			
		Hartlepool £7835		7 0 0	
		Haslingden, Lansh			
330	50	Hastings and St. Leonard's	50 0 0	6 0 0	60 0 0
		Haverfordwest			
		Haverhill			
		Haworth, Yorks.			
		Helstone			
		Hemel Hempstead			
300	10	Henley-on-Thams.	10 0 0		
		Hereford £5300		4 0 0	
		Herne Bay			
270	10	Hexham	10 0 0	7 0 0	12 0 0
		Heywood £10,000		7 10 0	
230	10	Hinckley	10 0 0	5 0 0	7 0 0
		Hindley, Lancash.			
		Hitchen			
		Hythe			
		Holbeach			
		Holmfirth £8325		6 0 0	
		Holyhead			
		Holywell (see British Provincial)			
		Honiton			
		Horncastle			
10		Houghton-le-Sprg.	10 0 0	8 0 0	
		Horsham			
		Howden			
		Hull, Sculcoats (see British Provin.)			
		Hull, Broadley-st. £11,712. 10s.		8 0 0	
		Hungerford			
		Huddersfield			
520	5	High Wycombe	5 0 0		5 0 0
		Hyde, Cheshire			
		Ilminster			
		Ilford			
		Ilfracombe			
		Ironbridge			
1400	10	*Ipswich*	10 0 0	8 0 0	15 0 0
1400	10	„ new shares	5 0 0	8 0 0	
800	25	*Isle of Thanet* (Ramsgate&Mar.)	20 0 0	5 0 0	19 to 20
		Kendal £7600		7 10 0	
		Kenilworth			
		Keswick			
100	25	Kettering	25 0 0	5 0 0	25 0 0
		Kiddermins. £8000		5 0 0	
		King's Langley			
		Kington, Hereford			
		Knutsford			
		Llanelly			
		Llandovery			
		Leamington Priors £20,000		6 0 0	
		Ledbury			
		Leeds Old Comp. old stk., £60,300		10 0 0	
		new „ £11,527		6 0 0	
		Leeds New Comp.			
		Leek			
		Leicester		7 0 0	
		Leigh			
125	20	Leighton Buzzard	20 0 0	5 0 0	
		Leominster			
		Leyburn, Yorksh.			
		Liskeard			
330	25	Lewes	25 0 0	5 0 0	23 0 0
		Lincoln £8000		10 0 0	
		Leyland, Lancash.			
250	20	Lichfield	20 0 0	7 10 0	27 10 0
		Liverpool United	100 0 0	10 0 0	146 to 148
		„ ¼ sh.	25 0 0	10 0 0	32 to 34
		Langport			
		London Comps.—			
5000	40	*British*	18 0 0	5 11 1	13 to 15
		„ debentures		4 0 0	
5000	20	„ Prov.—(Ayr, Clonmel, Gloucester, Holywell, Hull, Norwich, Stoke, Trowbridg)	20 0 0	7 0 0	19 to 21
	20	„ Prov., new	3 0 0	7 0 0	3 to 3½
	25	*Commercial*	25 0 0	5 10 0	25½ to 26¼
	25	„ new shres	10 0 0	5 10 0	pr. to ½pm.
	25	„ „	2 10 0	5 10 0	pr. to ½pm.
12,000	50	*Chartered*	50 0 0	6 0 0	
6000	50	„ new shares	10 0 0	6 0 0	
1000	100	*City of London*	100 0 0	10 0 0	
1000	100	„ new shares	75 0 0	10 0 0	
4000	50	*Equitable*	50 0 0	4 10 0	26 to 30
10,000	20	European—(Amiens, Boulogne, Caen, Havre, Nantes, and Rouen)	20 0 0	5 0 0	9 to 10
8000	50	*Impl. Continental*—(Amsterdam, Aix-la-Chapelle Antwerp, Berlin, Bordeaux, Brussels, Cologne, Frankft. Ghent, Haarlem Hanover, Lille, Marseilles, Rotterdam, Toulouse, Vienna)	42 0 0		30 to 35
7000	50	„ new shares	38 0 0		38 to 40
	50	„ third issue	42 10 0		52 to 55

Number of Shares issued.	Amount per Share	Name of Company.	Amount paid up per Share	Dividend per Cent. per Ann.	Price.
	£		£ s. d	£ s. d	£ s. d
10,000	50	*Imperial*	50 0 0	6 0 0	65 to 67
		„ debentures			
4000	40	*Independent* ...	40 0 0	6 0 0	60 to 62
8000	25	*London*	25 0 0		10 to 15
6000	25	„ preference	25 0 0	6 0 0	20 to 25
9000	50	*Phœniz*	47 0 0	5 0 0	27 to 29
320	50	*Poplar*	50 0 0	4 0 0	28 to 30
1600	100	*Ratcliff*	90 0 0	5 0 0	73 to 75
4000	25	*South Metrop.* ...	25 0 0	6 0 0	21 to 23
9000	50	UnitedGeneral—(Cork, Dublin, Limerick).....	50 0 0	2 10	14 to 16
12,500	20	Western	10 0 0		
		Lostwithiel			
		Loughborough.....			
240	25	*Louth*.....	25 0 0	6 0 0	26 10 0
		Lowestoft (see Beccles).....			
611	5	Ludlow Union.....	5 0 0	6 0 0	5 0 0
		Luton.....			
		Lyme Regis			
		Lymington			
		Malmesbury.....			
		Macclesfield			
		£20,000		4 13 5	
		Maidenhead.....			
250	50	Maidstone.....	50 0 0	10 0 0	100 0 0
		Maldon			
		Marlborough			
		Malton (New).....			
		Manningtree			
		Mansfield £5000		10 0 0	
		March			
		Margate (see Isle of Thanet)			
		Market Deeping...			
132	25	Market Harboro'	25 0 0	6 0 0	30 0 0
		Market Raisin.....			
		Market Weighton			
		Marlow			
370	10	Maryport	10 0 0	6 0 0	12 0 0
		Melksham.....			
		Melton Mowbray .			
		Merthyr Tydvil ...			
		Mere			
		Middleton £5000			
		Midsummer Norton			
		Middlesboro'			
		Mildenhall			
		Mitcham			
		Mold			
700	10	Monmouth Gas and Water.....	10 0 0	5 0 0	
		Monk Wearmouth			
		Moreton in the Marsh			
		Morley			
		Nantwich			
		Neath.....			
		Needham Market..			
		Newark £5000		10 0 0	
250	10	Newbury	20 0 0	5 0 0	20 0 0
13,000	5	Newcastle & Gateshead Union	5 0 0	10 0 0	6 12 6
		Newcastle-under-Lyne £5000		5 0 0	
600	5	Newmarket	5 0 0	6 0 0	5 0 0
		Newnham, Gloucestershire.....			
		New Mills & Hayfield £2115			
		Newport, Monmouthshire.....			
320	50	*Newport, Isle of Wight*.....	38 0 0	4 0 0	20 to 23
		Newport Pagnell			
		Newport, Salop ...			
		Newton Abbot.....			
		Newton, Lancashire			
		Northallerton			
		North Walsham ...			
		Northampton			
		Northwich			
		Norwich (see British Provincial)			
900	50	*Nottingham*	50 0 0	10 0 0	
900	50	New shares.....		10 0 0	
		Nuneaton			
		Oakham.....			
		Oakhampton			
200	10	Odiham, Hants....	10 0 0		10 0 0
		Oldham			
		Ongar.....			
		Ormskirk			
		Otley, Yorkshire...			
		Oundle			
		Oxford £18,000		9 10 0	
		Over Darwen £8000		5 0 0	
		Padstow			
		Pately Bridge, Yorkshire.....			
250	20	Penrith	15 0 0	6 10 0	21 0 0
		Penryn			
		Penzance			
200	10	Petworth	10 0 0	9 10 0	12 0 0
		Pickering			
3000	10	*Plymouth & Stonehouse*	10 0 0	6 0 0	11 0 0
		Pocklington			
		Pontefract.....			
400	10	Poole	10 0 0	5 0 0	10 0 0
		Port Madoc.....			
600	50	*Portsea Island* ...	53 0 0	5 0 0	47 to 49
400	10	Prescott	9 0 0	4 13 4	7 0 0
		Preston £52,500		10 0 0	
		Pwllheli.....			
		Pontypool			
		Pudsey			
		Radcliff and Pilkington £9000		4 12 10	
		Ramsay, I. of Man			
		Ramsgate (see Isle of Thanet).....			
1000	10	*Reading*	10 0 0	3 0 0	7 0 0
500	20	Reading Union ...	20 0 0	6 0 0	17 0 0
		Redditch			
		Redruth.....			
		Reigate			
		Retford (East).....			
		Richmond, Surrey			
		Ripon.....			
		Rochester and Chatham £14,000		6 0 0	
		Rochford			
		Rockingham.....			
		Ross			
		Rotherham £4000		10 0 0	
		Royston.....			
		Ruabon			
		Rugby			
		Rugeley.....			
		Ruthin			
		Runcorn.....			
500	10	Ryde	10 0 0	6 0 0	12 0 0
		Rye.....			
		Romsey			
		Saddleworth.....			
225	20	Saffron Walden ...	20 0 0	3 15 0	19 0 0
		St. Austel			
		St. Colomb			
		St. Helen's £7200		5 0 0	
		St. Ives, Hunting.			
		St. Ives, Cornwall			
		St. Neot's			
		Salisbury			
		Sandbach			
		Saxmundham			
		Scarborough.....			
		Selby			
		Settle			
290	10	Sevenoaks.....	10 0 0	5 0 0	10 0 0
		Shaftesbury			
5400	25	*Sheffield United*	24 0 0	8 6 4	32 0 0
		Shelton, Potteries (see Brit. Prov.			
		Shepton Mallet ...			
		Sherborne.....			
2914	5	Shields, North (Tynemouth) ...	5 0 0	3 0 0	5 0 0
		Shields (South) ...			
		Shiffnal, Salop			
		Shipley			
		Shipston-on-Stour			
		Shrewsbury £10,000		7 0 0	
400	10	Skipton	10 0 0	4 0 0	11 0 0
		Sleaford			
		Snaith			
		Soham			
		Southwold			
		South Molton			
1000	50	*Southampton*			
		Sowerby, Yorksh.			
		Stokesly			
		Stafford £10,000			
		Staines and Egham			
		Staley Bridge £15,000		10 0 0	
		Stamford £11,250			
		Stockton-on-Tees £3600		8 0 0	
840	9½	Stockton, New ...	9 10 0		8 0 0
960	10	Stoke-upon-Trent	10 0 0	6 10 0	12 0 0
500	10	„ new shares	3 0 0	6 10 0	5 0 0
		Stone, Stafford.....			
		Stoney Stratford ...			
		Sturbridge			
		Stowmarket.....			
150	20	Stratford-on-Avon	20 0 0	7 10 0	30 0 0
		Stroud			
169	10	Swaffham.....	10 0 0	5 0 0	5 10 0
		Swansea £9000			
		Sudbury.....			
		Sunderland, old.....			
6400	5	*Sunderland*, new ..	5 0 0		
		Swindon.....			
2800	5	*Taunton*.....	5 0 0		2 10 0
		Tadcaster			
		Tamworth.....			
		Tavistock.....			
		Teignmouth.....			
		Tenbury.....			
		Tenby.....			
		Tenterden £2000		2 10 0	
		Tetbury, Gloster...			
		Tewkesbury			
		Thetford			
		Thirsk			
		Thornbury.....			
		Thorne.....			
		Tiverton			
670	5	Todmorden	3 0 6		
		Torquay.....			
		Torrington, Devon			
		Totness			
		Tottenham		6 0 0	
		Towcester.....			
		Tring			
		Trowbridge (see British Provin.			
75	50	Truro	50 0 0	2 0 0	
		Tunbridge.....			
		Tunbridge Wells...			
		Ulverston.....			
		Uppingham			
		Usk, Monmouth ...			
		Uttoxeter.....			
		Uxbridge			
1000	25	*Wakefield*, old capl	25 0 0	6 0 0	24 0 0
1600	5	„ new „	5 0 0	6 0 0	4 16 0
300	10	Wallingford	10 0 0	5 0 0	8 0 0
		Wandsworth.....			
		Wantage.....			
		Warrington £18000		10 0 0	
100	10	Wareham	10 0 0	3 10 0	8 0 0
120	25	Warminster	25 0 0	5 0 0	27 0 0
		Warth			
		Warwick £15,000		6 0 0	
		Watford.....			
		Welchpool, Mntgy.			
		Wellingborough ...			
		Wellington, Salop			
		Wellington, Smrst.			
		Wells, Smrst. £4000		6 0 0	
		Westbury.....			
		Weston-sup.-Mare			
2000	5	West Ham	5 0 0	6 0 0	5 0 0
		Whitby			
		Whitehaven			
		Whittlesea			
		Wigan £10,160		5 0 0	
		Willenhall.....			
		Winchelsea.....			
		Winslow			
240	10	Wimborne Minster	10 0 0		
		Wincanton.....			
		Winchester			
900	12½	Windsor.....	12 10 0	10 0 0	23 0 0
		Witham.....			
		Witney.....			
4448	10	*Wolverhampton*, ...	10 0 0	7 10 0	11 10 0
		Woburn.....			
210	10	Wokingham	10 0 0		10 0 0
		Woodbridge			
		Wooler			
		Wotton-un.-Edge			
		Worcester.....			
		Workington			
		Worksop and Radford.....			
		Wirksworth			
		Worthing.....			
		Wrexham			
		Woolwich			
		Woolwich Consms.			
		Wymondham.....			
		Yarm			
795	20	Yarmouth	20 0 0		17 to 18
		Yeovil			
		York Untd. £55,000			
		SCOTLAND.			
		Aberdeen			
		Airdrie			
		Alloa			
		Anstruther.....			
		Ardrossan, nr. Saltcoats			
550	20	Arbroath	20 0 0	7 10 0	27 10 0
		Auchterarder.....			
		Auchtermuchty ...			
		Ayr, old (see Brit. Provincial).....			
		Ditto, new.....			
		Banff.....			
		Bathgate.....			
		Beith.....			
		Biggar			
300	6	Borrowstowness ...	6 0 0	5 0 0	8 0 0
		Brechin			
		Broughty Ferry, near Dundee.....			
		Burntisland			
		Campbelton.....			
		Clackmannan, near Alloa			
		Coatbridge.....			
		Coldstream			
		Collinsburgh			
		Crieff.....			
		Crail, Fife.....			
		Cumbernauld, near Glasgow.....			
600	5	Cupar Angus	5 0 0	6 0 0	5 10 0
250	10	Cupar Fife	10 0 0	7 10 0	14 0 0
		Dalkeith.....			
		Dingwall.....			
		Dumbarton.....			
400	20	Dumfries	14 0 0	5 0 0	20 0 0
		Dunbar.....			
		Dunblane.....			
		Dundee, old			
		„ new.....			
888	10	Dunfermline.....	10 0 0	6 0 0	12 12 0
		Dunkeld			
		Dunse.....			
		Dysart.....			
6000	25	*Edinburgh Gas Co.*	25 0 0	10 0 0	45 0 0
		„ *and Leith Co.* £150,000		6 10 0	
		Elie.....			
		Elgin.....			
		Falkirk, old			
		„ new.....			
		Falkland.....			
		Ferry Port on Craig, Fife.....			
		Forfar.....			
		Fort William.....			
		Fraserburgh			
		Galashiels.....			
		Girvan.....			
		Glasgow £122,500		5 0 0	
15000	10	*Glasgow City and Suburban*	9 0 0	7 10 0	9 0 0
		Grangemouth			
		Haddington			
		Hamilton.....			
		Hawick			
		Helensburgh.....			
		Inverary			
400	1	Inverkeithing	1 0 0	5 0 0	1 0 0
1200	10	*Inverness Gas and Water*	10 0 0	8 0 0	15 0 0
2400	5	„ new shares	1 5 0	8 0 0	2 5 0
		Irvine			

Number of Shares issued.	Amount per Share	Name of Company.	Amount paid up per Share	Dividend per Cent. per Ann.	Price.
	£		£ s. d	£ s. d	£ s. d
		Jedburgh			
		Keith			
		Kelso			
		Kilmarnock			
		Kinghorne			
		Kingskittlo, Fife			
		Kinross			
		Kirkaldy			
320	5	Kirkcudbright	5 0 0	5 0 0	5 0 0
1000	3	Kirkintulloch, near Glasgow	3 0 0	5 0 0	3 0 0
227	5	Kirkwall	5 0 0	5 0 0	4 10 0
518	5	Kirriemuir	5 0 0	6 0 0	
		Lanark			
		Largo, near Leven			
		Largs			
		Lasswade, n. Edin.			
		Lauder			
		Leith			
		Leslie, Fife			
		Lesmahago			
		Leven			
		Linlithgow			
		Linton, n. Nobleh.			
		Lochee, n. Dundee			
		Lochgilphead			
		Lochwinnoch, near Paisley			
1200	1	Markinch	1 0 0	7 10 0	1 5 0
		Mauchline			
		Maxwell-town, n. Dumfries			
		Melrose			
718	2	Mid & East Calder	2 0 0		2 0 0
192	5	Moffat	5 0 0		
		Montrose			
		Musselburgh			
		Nairn			
		Neilston, n. Glasg.			
		Newburgh, Fife			
		Newton Stewart			
		North Berwick, n. Haddington			
		North Queensferry			
		Oban			
		Peebles			
800	25	Perth	25 0 0	1 4 0	22 10 0
		Peterhead			
		Pittenweem			
		Pollokshaws, near Glasgow			
		Port Glasgow			
		Portobello, near Edinburgh			
		Prestonpans			
		Renfrew, n. Paisley			
		Saltcoats			
		Selkirk			
		South Queensferry			
		St. Andrew's			
		Stewarton			
		Stirling			
		Stonehaven			
		Stranraer			
		Strathaven, near Hamilton			
		Thurso			
		Tillicoultry, near Alloa			
800	1	Tranent	1 0 0		1 0 0
		Troon			
		Wick			
		Wigton			
		Wemyss		4 10 0	

Number of Shares issued.	Amount per Share	Name of Company.	Amount paid up per Share	Dividend per Cent. per Ann.	Price.
	£		£ s. d	£ s. d	£ s. d
		IRELAND.			
300	10	Armagh	10 0 0	8 0 0	14 10 0
700	50	*Belfast*	50 0 0		
		Ballymena			
		Carrick-on-Suir			
		Carrickfergus			
		Cashel			
		Carlow, new			
		Cork (see United General)			
		Coleraine			
		Clonmel (see British Provincial)			
		Drogheda			
19,000	10	*Dublin Consumers*	5 0 0	6 0 0	5 0 0
		Dublin Hibernian (see United Gen.)			
160	25	Dundalk	25 0 0		22 0 0
		Dungannon			
		Downpatrick			
		Enniskillen			
		Galway			
400	10	Kilkenny	10 0 0	8 0 0	11 5 0
		Limerick (see U.G.			
1725	5	Limerick Consum.	5 0 0	5 0 0	5 0 0
600	15	Londonderry	15 0 0	6 13 4	21 10 0
500	6¼	Lisburn	6 5 0	0 5 0	6 5 0
520	10	Lurgan	6 0 0	6 0 0	6 0 0
		Monaghan			
		Nenagh			
418	5	Newtownards	5 0 0	4 0 0	5 0 0
		Newry			
125	20	Portadown	13 0 0		
		Sligo			
		Waterford			
		Wexford			

The Gas Works in the undermentioned towns belong to private individuals:—

Carlow, old. Deal. Ely. Farsley. Gainsborough. Goole. Hertford. Holt. Huntingdon. Kingston-on-Thames. Lancaster. Lynn. Morpeth. Oswestry. Peterborough St. Alban's. Sandwich. St. Heller's, Jersey. Sheerness. Sidmouth. Sittingbourne. Stockport. St. Peter's Port, Guernsey. Spalding. Romford. Thame. Waltham Abbey. Ware. Wem. Weymouth. Whitchurch (Salop). Wisbeach.

The Gas Works belong to the Corporations, or to Commissioners acting under special acts of Parliament, in the following towns:—

Greenock. Keighly. Knaresborough. Manchester. Milton (Kent). Paisley. Rochdale. Rothesay. Richmond (Yorkshire). Salford. Strabane. Walsall. Wells (Norfolk).

*** We should feel greatly obliged by agents, or others interested, furnishing us with such corrections for our Share List as we may not have received through our usual channels of communication; our object being to present as accurate a list of prices as can be obtained; to procure which, we solicit the aid of correspondents in general.

Price Current.

The following List of Prices is corrected by an eminent wholesale house in each trade up to the latest period:—

CASTINGS, per Ton.

Average Weight of Cast Iron Pipes, per Yard.

1½ in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lbs.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow	Newcastle.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pig Iron, No. I.	3 12 6	2 15 0	3 5 0	4 0 0	3 15 0
1¼ and 2 inches Socket Pipes	6 7 6	5 7 6	5 17 6	6 2 6	6 2 6
2½ and 3 do. do.	6 5 0	5 5 0	5 15 0	6 0 0	6 0 0
4 and 5 do. do.	6 2 6	5 2 6	5 12 6	5 17 6	5 17 6
6 inches and upwards do.	6 0 0	5 2 6	5 10 0	5 15 0	5 15 0
Extra for bends, branches, and connection	2 0 0	2 0 0	2 0 0	2 0 0	2 0 0
Retorts, 1st fusion	5 10 0	..	..	5 5 0	5 7 6
Do. 2nd fusion	5 17 6	4 17 6	5 5 0	5 12 6	5 12 6
Tank Plates, ¼ thick and above	5 17 6	5 5 0	5 7 6	5 15 0	5 15 0
Do. less than ¼	6 2 6	5 7 6	5 12 6	..	5 17 6
Plain Castings ex. models	6 2 6	5 7 6	5 12 6	5 17 6	5 17 6

COALS.

NEWCASTLE. Unscreened.	s. d.	
Tyne Main	5 6	per ton.
Ravensworth Pelaw, Dean's Primrose	5 9	"
Pelton, Medomsley, New Tanfield	6 0	"
Pelaw	6 3	"
Eighton Moor, Felling Main, Hutt's Tanfield, New Pelton, Peareth, South Pelaw, Waldridge, South Peareth, South Pontop	6 6	"
Ramsay's Cannel	15 0	"

DERBYSHIRE. Unscreened.	s. d.	
Clay Cross, Deep Main, Jerries, New Birchwood, New Shipley, Sleight's, Soft Main	6 6	per ton.
SCOTCH CANNEL.		
Kirkness best	23 0	"
Ditto seconds	14 0	"
Lothian	18 0	"
Lesmahago	16 0	"
Wemyss	15 0	"
Dombristle	12 0	"
Lethans, Bridgeness	12 0	"
Kinneil, Lochgelly	11 0	"
Lumphumans	10 0	"

FIRE GOODS.

Best Fire Bricks, 60s. per thousand, at Newcastle.
Do. Clay, 12s. per ton do.

WROUGHT IRON TUBING, subject to 25 per cent. Discount.

	2 inches.	1½ inch.	1¼ inch.	1 inch.	¾ inch.	½ inch.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent welded tubes, from 4 to 12 feet, per foot	1 8	1 0	0 10	0 7	0 5	0 4½
Ditto " 2 to 4 feet	One	penny	per foot	extra.		
Ditto " 6 in. to 18 in., each	3 0	2 0	1 9	1 3	1 0	0 9
Connecting pieces, or long screws	3 6	2 3	2 0	1 6	1 2	0 11
Bends, wrought iron	3 9	2 3	1 9	1 0	0 10	0 8
Springs, wrought iron	3 9	2 3	1 9	1 0	0 10	0 8
Elbows, wrought or cast	3 9	2 3	1 9	1 0	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 10
Crosses, wrought or cast	4 6	3 0	2 6	2 0	1 6	1 2
Iron cocks	17 6	9 6	7 6	4 6	3 3	2 6
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing sockets	1 3	0 9	0 8	0 6	0 5	0 4
Plain sockets	1 0	0 8	0 7	0 5	0 4	0 3
Caps, plugs, nipples, backnuts	1 3	0 9	0 8	0 6	0 5	0 4
Flanches	1 9	1 6	1 3	1 0	0 9	
Syphons, 2 quart	15 0	14 0	13 6	13 0	12 0	
Ditto 1 quart	11 0	10 0	9 6	9 0	8 6	
Tongs or nippers, each pair	9 0	7 0	6 6	5 6	4 9	4 6
Elbow burners, per dozen	7 6	jet or batwing.				
Straight burners "	6 0	ditto.				
Stocks, dies, and taps, for 2 inch, 1¼ inch, and 1½ inch tubing					£8 10s. 0d. per set.	
Ditto, do. and do. " 1 " ¾ " and ½ " "					5 5 0 "	
Ditto, do. and do. " ¼ " 2-8 " and ¼ " "					3 0 0 "	

FREIGHTS, per Ton.

Coastwise—Newcastle.

	s. d.
Chatham & Roches.	7 3
Colchest. & Maldon	6 9
Cork	9 0
Dartmouth	9 0
Devonport	9 0
Dover	7 0
Dublin	9 0
Exeter Quay	9 6
Faversham	7 6
Folkestone	7 4
Hastings	8 0
Ipswich	6 0
Jersey	9 0
London	6 9
Lowestoft	6 0
Lynn	6 0
Limerick	11 0
Margate	6 6
Newhaven	7 6
Portsmouth	8 0
Plymouth	9 6
Rye	8 0
Southampton	7 9
Totnes	8 0
Teignmouth	8 6
Weymouth	8 6
Yarmouth	6 0

Foreign.

	s. d.
Algiers	20 0
Amsterdam	9 6
Antwerp	9 0
Boulogne	7 6
Barcelona	20 0
Bordeaux	12 0
Calais	7 6
Caen	9 0
Cadiz	11 0
Cette	17 0
Dieppe	8 6
Genoa	16 0
Hamburg	
Havre	9 6
Honfleur	10 0
Leghorn	17 0
Lisbon	11 0
Marseilles	15 0
Nantes	12 6
Naples	21 0
Rotterdam	8 6
Rouen	12 0
Toulon	17 6
Trieste	20 0
Venice	22 0

Miscellaneous News.

Cheap Pipes.—We lately gave a list of tenders received by the Southampton Water Commissioners for cast-iron pipes, which varied from £234 10s. to £64 6s. The last-mentioned tender was accepted. We now learn that the fortunate parties have discovered an error in their estimate, in having mistaken *yards* for *feet*. They would probably have stood second on the list. They say they will complete the contract, and throw themselves on the generosity of the board. Several of its members, however, think that it will not be just to the other parties who tendered to make any compensation for such a mistake, and so the commissioners will have made a good bargain by their "cheap contract."

Great Central Gas Company.—The directors of this company have accepted a tender from Messrs. Peto and Betts, the eminent contractors, to erect the whole of their works, laying mains, &c., for the sum of £106,880. The streets are only to be opened for main-laying at night: the pavement being made good before eight o'clock in the morning; and the *whole* work to be finished by the *24th of June next*. The contractors agree to receive one-half the amount in paid-up shares. A contract is also entered into with Mr. Croll, to manufacture at their works, the whole of the gas they may require, delivered into their gas-holders at 1s. 4½d. per thousand feet, for five, seven, fourteen, and twenty-one years, at the option of the company. The works are to be commenced forthwith.

Flow of Gas through Pipes.—A correspondent of the *Mechanic's Magazine* makes the following observations on this subject:—"In no department of gas engineering is there more need of experimental information than in that of the flow of gas through pipes, inasmuch as the results given us by rule do not agree with those in practice. I believe that the same inconsistency holds in regard to the flow of water and other fluids; but, my experience being confined to gas, I will limit my observations to that branch of the subject. I have read the best works upon the subject, and had the private opinions of the most eminent engineers; and, with one exception, I have been told that, for the difference of length, the discharge will be inversely as the square roots of the lengths, and that, for different diameters, the discharge will be directly as the squares of the diameters. To take an instance:—A pipe, 6 inches in diameter and 500 yards long, is found to deliver 3686 cubic feet; whereas the same pipe, if extended to 1000 yards in length, will only deliver 2606 cubic feet. This has been proved by experiment, and we will assume it to be correct. But we are told that a pipe, 12 inches in diameter and 500 yards long, will deliver only 14,744 cubic feet; or, if extended to 1000 yards in length, its discharge will be reduced to 10,424 cubic feet. In both cases it will be observed that the amount said to be delivered by the 12-inch pipe is exactly four times that delivered by the 6-inch pipe, or as the square of the area; and here I disagree with those who have written before me. In a calculation of this kind there are involved a great many intricacies; but I will pass over those minor considerations, such as the friction of the particles one against another, &c., which theory, perhaps, more than practice, would lay stress on, and merely advert to what appear to be the main causes requiring notice, —namely, the gravitating power or inertia of the gas, and the surface against which it has to rub during transmission, these having to be overcome by the force or pressure employed. Let us see, then, how this applies in the case before us. A pipe 6 inches in diameter is, in circumference, 18·8496 inches; and four such pipes, equal in capacity to one 12-inch pipe, are in circumference, 75·3984. Now, a pipe 12 inches in diameter is in circumference 37 6992 inches or just one half; so that in one case we have double the rubbing surface which we have in the other. Under such circumstances I pronounce it physically impossible that the discharge can be the same. I am aware that some modern writers have remarked that there will be a slight advantage in favour of the larger pipe, from the cause I have just mentioned; but I contend that a passing notice of such an important point is not enough, inasmuch as large pipes, from 12 to 16 and 18 inches in diameter, will deliver from 40 to 70 or 80 per cent. more than the rule gives. We have found that when the 6-inch pipe was 500 yards in length it delivered 3686 cubic feet, and when extended to 1000 yards in length its delivery was reduced to 2606 cubic feet. Now, in thus extending the pipe, what did we do? Why, increase the rubbing surface. We thus have a rule for calculatiug the effect of length friction, while side friction is entirely overlooked, just as if there was any important difference between one and the other. For the reasons above stated I have been led to add one additional rule, viz., that the discharge will be inversely as the square root of the rubbing surface. A 12-inch pipe, therefore, will deliver at 1000 yards' length 14,731 cubic feet, an addition of 41 per cent. The difference appears more conspicuous in very large pipes; thus an 18-inch pipe is reckoned to deliver, at 1000 yards, 23,454 cubic feet, whereas, by my calculation, it will deliver 40,677 cubic feet. I am not able to say that I have proved this rule by experiments expressly made for the purpose; nevertheless I am prepared to say that it agrees with my experience of the action of large pipes better than any other rule I can apply. I therefore throw it before your readers to receive their scrutiny, and shall be happy to hear of any rule that will answer existing objections better."

Experiments on the Discharge of Water from Pipes (made under the Sanction of the Metropolitan Commissioners of Sewers).—The following remarks, extracted from a letter of Mr. J. L. Hales, C.E., published in "The Mechanics' Magazine," will be interesting to many of our readers, as it often occurs that, in our provincial towns, the management of the gas and water works is united under one and the same person. We must premise that it was necessary to conduct these experiments, as to arrangements of apparatus, in a different manner than if it had been required to know the necessary size of pipes for the supply of a town with water, as in the former case, there being no pressure arising from "head," a flow of water of uniform section is maintained by the continued addition of lateral streams, and the *length* of the aqueduct, therefore, may have little or no influence on the velocity of the current, while in the case of water works, the velocity of the water depending on the "head" at the origin of the system, length of pipe is a most important element of friction. In the latter work the power is generated at once at the head of the system, and is continually being expended so long as it acts; but in the former case, force is self-generating, and accumulates as the operation enlarges. Hence it is easy to see what an important part friction plays in the one case to what it does in the other. Still we think the result of the following experiments will not be altogether uninteresting to the class for whom this notice is intended:—"The apparatus used was as follows:—A strong platform, 100 feet long, was erected, fixed to move about a central axis at one end, and free to be moved at the other by a chain and windlass, so as to afford a range from the horizontal plane to a declivity of 1 in 10. A tank, holding 1600 gallons, was placed at the upper end, and another tank, of sufficient dimensions, received and measured the water discharged at the lower end. On this platform lines of pipes, varying from 3 inches to 12 inches diameter, were tried. The pipes consisted of the ordinary Vauxhall stoneware, in two-feet lengths; and a careful selection of them was made as to accuracy of bore and dimensions. They were laid in straight lines of uniform inclination, and the pipe joints were rendered water-tight with clay. On each side of a line of pipes five junctions were attached at intervals, by which the water was admitted, as well as at the head of the pipe. The entrance of the water was regulated by sluices; so that while the head of the pipe was just filled, water was at the same time admitted by the junctions sufficient to maintain the pipe full throughout its entire length. Under these circumstances we found—to mention only one result—that a line of 6-inch pipes, 100 feet long, at an inclination of 1 in 60, discharged 75 cubic feet per minute. The same experiment, repeated with the line of pipes reduced to 50 feet in length, gave very nearly the same result. Without the addition of junctions, the transverse sectional area of the stream of water, near the discharging end, was reduced to one-fifth of the corresponding area of the pipe, and it required a simple head of water of about 22 inches to give the same result as that accruing under the circumstances of the junctions. In varying sizes and inclinations we found that the squares of the discharges are as the fifth powers of the diameters; in steeper declivities than 1 in 70, the discharges are as the square roots of the inclinations; but at less declivities than 1 in 70, the ratios of the discharges diminish very rapidly, and are governed by no constant law. At a certain small declivity the relative discharge is as the fifth root of the inclination; at a still smaller declivity it is found as the seventh root of the inclination; and so on as it approaches the horizontal plane. This may be exemplified by the following results found by actual experiment:—

Discharges of a 6-inch Pipe at several Inclinations.

Inclination.	Discharges in 100 ft. per minute.
1 in 60	75
1 in 80	68
1 in 100	63
1 in 120	59
1 in 160	54
1 in 200	52
1 in 240	50
1 in 320	49
1 in 400	48·5
1 in 480	48
1 in 640	47·5
1 in 800	47·2
1 in 1200	46·7
Level	46

The conclusion arrived at is, that the requisite sizes of drains and sewers can be determined (near enough for practical purposes) by taking the result of the 6-inch pipe, under the circumstances before mentioned, as a *datum*, and assuming that the squares of the discharges are as the fifth powers of the diameters. That at greater declivities than 1 in 70 the discharges are as the square roots of the inclinations. That at less declivities than 1 in 70 the usual law will not obtain; but near approximations to the truth may be obtained by observing the relative discharges of a pipe laid at various small inclinations. That increasing the number of junctions at intervals accelerates the velocity of the main stream in a ratio which increases as the square root of the inclination, and which is greater than the ratio of resistance due to a proportionable increase in the length of the aqueduct. The velocities at which the lateral streams enter the main line is a most important circumstance governing the flow of water. In practice these velocities are constantly varia le, co nsidered individually, and always different considered collectively, so that their united effect it is difficult to estimate. It should be mentioned that in the case of the 6-inch pipe, which discharged 75 cubic feet per minute, the lateral streams had a velocity of a few feet per second, and the junctions were placed at an angle of about 35° with the main line. It is needless to say that all junctions should be made as nearly parallel with the main line as possible, otherwise the forces of the lateral currents may impede, rather than maintain or accelerate, the main streams. The conclusion of the labours of the many learned authors who have written on the subject has left the science of hydraulics in such a state that no man, except by his own practical observation, could tell what an aqueduct, under any given conditions, would discharge. This will be so apparent to any one who will take the trouble to examine and compare the various formulæ, the one with the other, that I need not dwell on it. It would be a valuable thing if practical men would make a common record of facts occurring in their own experience—*facts, not conclusions derived*. No doubt the facts exist in sufficient abundance; and, had such a record been current, the formulæ of the hydraulicians could not have been received as orthodoxy by the scientific world."

IRISH MANUFACTURE.

JAMES GRAY and CO. continue to make every description of FIRE-BRICKS, TILES, and BLOCKS used in setting Retorts, all of the very best fire clay.

Irish Gas Companies can be supplied with as cheap and good an article, manufactured in their own country, as any they can import.

Fire-clay and Brick Works, Coal Island, near Dungannon, county of Tyrone, May 28, 1849.

N.B. Flooring, Ridge, and Oven Tiles, Water Pipes, Flue Linings, &c. &c.

THE MOST PERFECT DRY GAS METER.

N. DEFRIES, Engineer, Inventor and Patentee, 10, Hampstead-road, and 67, St. Martin's-lane, London, having, by the SALE of nearly 30,000 METERS, established, beyond all doubt and precedent, their unequalled character, begs to direct the attention of the Gas Companies, the Gas Fitters, and the Public, to the following particulars:—That nearly 30,000 are now in action; that the powerful Chartered Gas Company have more than 6000 alone in use; that he has recently constructed, upon the order of the above Company, a Meter for the New Houses of Parliament, calculated to pass 10,000 feet of gas per hour, and to supply 2000 burners, and which has been pronounced by all the daily and weekly journals and the first men of the day to be the most magnificent measuring machine ever constructed by human hands; that a Meter of almost equal dimensions was recently constructed by him, also upon the order of the Chartered Gas Company, for the Italian Opera-house, Covent-garden, calculated to pass 6000 feet of gas per hour, and to supply 1500 burners, and which works with only the loss of one-half a tenth pressure; that he has supplied many large Meters to Government Offices, Public Companies, Club-houses, Churches, Chapels, Theatres, &c., too numerous to mention; that two large Meters have been in action at the Thames Tunnel night and day for five years, being equal to forty years of ordinary use; and the registration, being recorded daily, offers the most incontestable proof that, on the score of precision and durability, they stand unequalled; that these Meters have been proclaimed by the first scientific gentlemen of the day to be the surest tests that could be made; and eight years' flattering experience has proved them to be wholly free from all the evils and annoyances attendant upon the water meter, of the truth of which the annexed testimonial bears striking evidence:—

"Woolwich Protective Consumers' Gas Company,
"Jan. 15, 1849.

"Sir,—I have great pleasure in giving my testimony to the excellence of the dry meter, and think there is no comparison between that and the water meter, as regards the value of the two instruments. Experience confirms this opinion. We have had several hundreds of yours in work for nearly five years with the utmost success. They are perfect in registration, have no undulation in the lights, are free from the action of frost, and, above all, require no attention when once fixed. I have taken down several that have been at work for the above time, and, on testing them, found they registered as correctly as when first made. I am confident I cannot say too much in praise of dry meters; and that all gas proprietors who furnish pure gas would find it to their interest to use them only.

"J. THOMAS, Superintendent Engineer.

"To Mr. Defries"

Experimental Glazed Meters may be seen in action at
Mr. Faraday's, Wardour-street, Soho.
— Warris, Wardour-street, Soho.
Messrs. Dean and Dray, Arthur-street, London-bridge.
Mr. Baker, Manor-house, King's-road, Chelsea.
Institution of Civil Engineers, 25, Great George-street.
Royal Polytechnic Institution, Regent-street.
The Bank of England,
Mr. Boccius, Patent Light Office, 14, Duke-st., Adelphi.
And at the following Gas Fitters and Lamp Manufacturers:—
Mr Deville, 367, Strand.
Messrs. Debaufer and Son, Creed-lane, Ludgate-hill.
— Dowson, 69, Welbeck-street.
— Brocklehurst and Co., 177, High Holborn.
— Huxley and Herlot, 16, Castle-street, Long-acre.
Mr. Hodder, 9, Tottenham-court-road,
— Kitchen, 60, Crawford-street, Marylebone.
— Rickets, 5, Agar-street, and 14, Threadneedle-st.
— Slater, 23, Denmark-street, Soho.
— Baker, Manor-house, Chelsea.
— Shirley, 3, Back-road, Batcliff-highway.
— Gardner, 453, Strand.
— Carter, 41, Exeter-street, Portland-market.
— Petitt and Son, 17, Brook-street, New-road.
— Verity, 31, King-street, Covent-garden.
— Rothwell, 20, Cleveland-street.
— Williams, 14, Sloane-square, Chelsea.
— May, 21, Berwick-street.
— Edgar, 71, Marylebone-lane.
— Pilkington, 26, Great Marylebone-street.
— Greening, 15, West-street, Seven-dials.
— Harris, Wardour-street, Soho.
— Edgar Parkes, Fleet-street.

In conclusion N. Defries begs to say, that he has been extensively patronized by all the London and by most of the Provincial Gas Companies; that any or all of them will on application testify to the correctness, durability, and value of his Meters; that these Meters have been successfully introduced to the Continent, to America, and many of the Colonies; that they have proved themselves to be unvarying, correct, and durable instruments, and may be obtained at a small expense per annum of all Gas Companies who supply Meters to their customers; that they combine safety and economy, as no water is used, and require no attention when once fixed.

Testimonials, Lists of Prices, and every information may be obtained at either Factory, 10, Hampstead-road, or 67, St. Martin's-lane.

BY HER MAJESTY'S ROYAL LETTERS PATENT.

CROLL and GLOVER, Patent Dry Gas Meter Manufacturers, Suffolk-street, CLERKENWELL-GREEN, LONDON, beg respectfully to call attention to the following extracts from testimonials in favour of their Meters. The respectability of the parties will be esteemed by all acquainted with gas matters as affording the most indubitable evidence of the superiority of their Patent Dry Gas Meters, proving that gas companies and gas consumers may rely on them for a just and unvarying registration, durability, and the absence of all trouble arising from condensation of water in the fittings, and the impossibility of their being stopped by freezing in the coldest climates.

CROLL and GLOVER take this opportunity of remarking to Gas Companies that the apprehension so generally entertained by them, viz., that if Dry Meters were introduced into their districts their Stock of Water Meters would be thrown on their hands, while this has not happened even with those Gas Companies who have for years back purchased none but Dry Meters; this apprehension ought to lead Gas Companies to a speedy investigation into the merits of Dry Meters, so that they may not, year after year, be increasing their stock of Water Meters, which they themselves apprehend must one day be thrown out of use.

CROLL and GLOVER humbly think that the following extracts prove that the merits of their Meter are entitled to prompt attention of Gas Companies.

Almost all the testimonials bear the date of November, 1848.

EXTRACTS.

"The Chartered Gas Company have purchased and fixed up above 2,000."—GEORGE LOWE, *Civil Engineer, F.R.S., &c., Consulting Engineer to the Chartered Gas Light and Coke Company, London.*

"We have in this district from seven to eight hundred, and are daily fixing more."—F. I. EVANS, *Superintendent at Chartered Gas Light and Coke Company's Station, Brick-lane.*

"I invariably found the flames perfectly steady, and the gas accurately measured."—A. H. STILL, *Superintendent at Chartered Gas Light and Coke Company's Station, St. Luke's.*

"I beg to state that out of 800 Meters of the square form, and anti-corrosive metal, I find only twenty have been entered in our return-book, chiefly for broken index-glasses. The company are continuing to purchase and fix up your Meters in considerable quantities."—WILLIAM MONRO, *General Superintendent and Engineer of the Phœnix Gas Light and Coke Company, London.*

"I have much pleasure in stating that the Meters we have received with your last improvements have given great satisfaction."—JOHN AIRD, *Superintendent of the Phœnix Gas Light and Coke Company's Station, Greenwich.*

"I have had some of them in use for nearly four years. In certain situations exposed to the influence of the climate I have found them to be the only description fit for use, as well as in confined and overheated situations, where the water in the Water Meters is acted upon by evaporation."—ROBERT LAING, *Secretary and Superintendent of the Independent Gas Light and Coke Company, London.*

"Having had, in all, up to the present time under my inspection 609 Meters of your manufacture, a very good opportunity has thus been afforded me of judging of their merits. The result of my observation in respect of registration and steadiness of light is, that the Meters have given perfect satisfaction."—D. METHVEN, *Engineer and Superintendent to the Commercial Gas Light and Coke Company, London.*

"The advantages which I have found attending the use of your Dry Gas Meters, in preference to the Wet Meters, are so important, that nothing would induce me to return to the use of the latter. As Station Meters yours have the additional advantage, that there is no water-line to attend to, or to be subject to neglect."—CHARLES DIXON, *Engineer of the Chichester Gas Light and Coke Company.*

"I have also had sufficient opportunity of knowing that they are not affected by the most severe frost, nor where one of them was fixed did I ever know of condensation taking place in the inside gas fittings of any premises."—SAMUEL PONTIFEX, *Manager, Winchester Gas Light and Coke Company.*

"We are now using your Meters solely."—CHARLES PURVES, *Manager, Gas Works, Gosport.*

"It is now nearly 2 years since we commenced using upwards of 100 of your Dry Meters, and during the whole of that time have not taken one of them down, for any cause whatever. This is an unvarnished, practical fact, and unprecedented, as far as my experience goes; therefore I have no hesitation in stating that I prefer them to every other Meter with which I am acquainted."—J. THOMAS, *Manager, Consumers' Protective Gas Light Company, Woolwich.* April 19, 1849.

"Previous to using them I held theoretical objections, which I can now say have been removed, and their superiority as an instrument of unvarying measuring capacity has been fully established."—EDWARD H. THORMAN, *Superintendent of the West Ham Gas Company.*

"I have delayed giving my opinion of your Meters until I had had another winter's experience; and, notwithstanding some of them were placed in the open air, not one became fixed. We have had a short winter, but the frost is very severe."—P. T. W. de TIMMERMAN, *Director of the City of Leyden Gas Works.* Jan. 26, 1849.

Station Meters, Station Governors, Pressure Registers, Experimental Meters, and Specific Gravity Apparatus.

CANNEL COAL.

JOHN HENDERSON and CO. respectfully invite the attention of Managers of Gas-works to the annexed Report by Professor Fyfe upon their PARROT or CANNEL COAL, which continues to be shipped at Burntisland to any extent. Price 10s. per ton, f. o. b.

Apply to Messrs. R. W. KENNARD and Co., 67, Upper Thames-street, London; or to JAMES CONNEL, Shipping Agent, Burntisland.

Lochgelly Coal and Iron Works, by Burntisland, March, 1849.

REPORT ON THE VALUE OF LOCHGELLY PARROT COAL FOR THE MANUFACTURE OF GAS.

In the trials made with this Coal 14 lbs. of coal were carbonized. The quantity of gas given off was estimated by meter; the illuminating power of the gas was ascertained by the chlorine test, the durability by meter—consuming the gas with a single jet of 1·33 of an inch diameter, and with a 5-inch flame. The specific gravity was taken in the usual way.

The following are the results, being the average of several trials:—

Cubic feet of gas ..... 9123· per ton of coals.
Illuminating power of gas ... 14·5 candles.
Durability ..... 65·30 minutes.
Specific gravity of gas ..... 567·

The Lochgelly Coal may be considered as a fair average quality of Parrot Coal; for, though it is beneath the Lesmahago Coal, not only as regards the quantity of gas afforded, but also as to the illuminating power and durability of the gas, yet it is equal to the average quality of the Parrot Coal of the Lothians and of Fifeshire.

It is much more valuable than the English Caking Coal and English Parrot Coal now in general use, in regard to their relative value for the amount of light afforded by the combustion of their gases, as the following table will show:—

COALS.	Cubic Feet of Gas from Ton of Coal.	Illuminating Power of Gas by Chlorine Test.	Durability of Gas with Jet of 1·33 of an Inch. Min.	Sec.	Comparative Value of the Coals according to the Light afforded by the Consumpt of their Gases.	
English Caking Coal	8000	4·33	40	24	1·	—
English Parrot ditto	9500	7·6	44	0	...	1·
Lochgelly ditto	9123	14·5	65	30	6·18	2·71

Accordingly, the Lochgelly Coal is, on an average, more than six times the value of English Caking Coal, and more than twice and a half as valuable as the average of English Parrot Coal, for affording light by the combustion of their gases.

A ton of Lochgelly Coal leaves 1200 lbs. of coke.

In the above estimate the value of the ammoniacal liquor, tar, &c., is not taken into account.

A. FYFE, Professor of Chemistry,
Feb. 28, 1849. King's College University, Aberdeen.

BRYMBO Iron Works, Foundry, and COLLIERY, near WREXHAM, NORTH WALES. Shipping Ports:—Birkenhead, and Saltney, near Chester, on the river Dee.

Report of Experiments made at the Wrexham Gas Works on the 3rd, 4th, and 5th, and at the Chester Gas Works on the 6th and 7th, of August, 1848, upon the Gas Coals raised at the Brymbo Colliery, by Mr. A. WRIGHT, Gas Engineer, London.

At one work Fire-clay Retorts were used at a high temperature; at the other Iron Retorts at a moderate temperature; the results are, therefore, given separately, Clay and Iron being given as synonymous with high and moderate heats.

TWO YARD COAL.

CLAY RETORTS, 2 cwt. charge. 5½ hours.

Per Ton:
Gas Cubic Feet 8880.
Sp. Gr. first of Charge ·596 middle ·462 last ·300 — Mean Sp. Gr. 463. 5 feet per hour, equal to 15 candles.
Gas by Weight 294·94 lbs.
Tar 70 „
Coke 12 cwt. 22 lbs.

The Coke of very superior quality.

POWELL COAL.

CLAY RETORTS, 2 cwt. charge. 5 hours.

Per Ton:
Gas Cubic Feet 10165.
Sp. Gr. first of Charge ·586 middle ·456 last ·428 — Mean Sp. Gr. 459. 5 feet per hour, equal to 14·88 candles.
Gas by Weight 337·8 lbs.
Tar 70 „
Coke 11 cwt. 56 lbs.

POWELL COAL.

IRON RETORTS, 1½ cwt. charge. 5 hours.

Per Ton:
Gas Cubic Feet 8250.
Sp. Gr. first of Charge ·560 middle ·465 last ·300 — Mean Sp. Gr. 470, equal to 15·3 candles, at 5 feet per hour.
Gas by Weight 295·6 lbs.
Tar 105·0 „
Coke 11 cwt. 56 lbs.

This Coal yields Gas very easily, of a good quality, and at a moderate heat. The Coke is also, though small, very good. It is therefore well fitted for those who use Iron Retorts and require a superior Gas.

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